

A REVISION OF THE OLD WORLD  
GENUS *ZAMARADA* (LEPIDOPTERA:  
GEOMETRIDAE)

BY  
DAVID STEPHEN FLETCHER

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## SYNOPSIS

All the 222 known species of the Old World genus *Zamarada* are described and illustrated. A key to the species-groups based on the male genitalia is provided; keys to species-level follow each species-group heading. The 102 species previously known are re-described, 120 species and 12 subspecies are described as new; 12 specific names are newly placed in synonymy, 5 names are restored to specific status from synonymy and one name is given new status. The affinities of *Zamarada* with other Old World genera are discussed and an account is given of the distribution of the genus. A check-list of species is included. Species originally described in *Zamarada* and transferred, either previously or in this publication, have been listed together with the new binomen.

## MATERIAL EXAMINED

THE revision is based on the study, not only of the material in the collection of the British Museum (Natural History), which now includes the very rich collections of the late Lord Rothschild, J. J. Joicey, Charles Oberthür and L. B. Prout, but also of the extensive collection of Cameroun *Zamarada* formed by H. L. Weber, now deposited in the Carnegie Museum in Pittsburgh, and of material which has been loaned by most of the major museums in Europe and Africa and by Monsieur C. Herbulot of Paris, whose immaculate private collection of *Zamarada* was most kindly placed at my disposal. In all some 8000 specimens and 1500 genitalia slides have been studied. All sources are listed in the Acknowledgements.

The holotypes or lectotypes of all but four taxa have been examined; the type-specimens of *Phalaena eucharis* Drury and of *Zamarada pulverosa* Warren have

been lost or destroyed and each has been replaced by a neotype; *Z. rubrifascia* Pinhey and *Z. minimaria iranica* Brandt are represented in the BMNH by topotypical paratypes.

All specimens studied by the author during the preparation of this revision have had identification labels affixed.

In the text of the revision, material examined has been listed by country or, in the case of South Africa, by province; unless otherwise indicated, all specimens are in the British Museum (Natural History). Specimens deposited in other institutions are indicated by abbreviations of those institutions' titles. A list of the abbreviations used is given below.

|      |                                                                                       |
|------|---------------------------------------------------------------------------------------|
| ARS  | Agricultural Research Station, Kawanda, Uganda.                                       |
| BMNH | British Museum (Natural History), London.                                             |
| CM   | Carnegie Museum, Pittsburgh.                                                          |
| DEI  | Deutsches Entomologisches Institut, Eberswalde.                                       |
| FRIC | Forest Research Institute & Colleges, Dehra Dun.                                      |
| IAR  | Institute for Agricultural Research, Ahmadu Bello University, Samaru, Zaria, Nigeria. |
| IFAN | Institut Fondamental d'Afrique Noire, Dakar.                                          |
| IPN  | Institut des Parcs Nationaux du Congo et du Rwanda, Brussels.                         |
| MBG  | Mission Biologique au Gabon, in MNHN, Paris.                                          |
| MHN  | Muséum d'Histoire Naturelle, Geneva.                                                  |
| MM   | Moravian Museum, Brno.                                                                |
| MNHN | Muséum National d'Histoire Naturelle, Paris.                                          |
| MNHU | Museum für Naturkunde der Humboldt-Universität, Berlin.                               |
| MRAC | Musée Royal de l'Afrique Centrale, Tervuren, Belgium.                                 |
| MRHN | Musée Royal d'Histoire Naturelle Belgique, Brussels.                                  |
| NMK  | National Museum, Nairobi, Kenya.                                                      |
| NMR  | National Museum of Rhodesia, Bulawayo.                                                |
| NMS  | Natur-Museum und Forschungs-Institut Senckenberg, Frankfurt a. M.                     |
| NMV  | Naturhistorisches Museum, Vienna.                                                     |
| RNH  | Rijksmuseum van Natuurlijke Historie, Leiden.                                         |
| SAM  | South African Museum, Cape Town.                                                      |
| SMN  | Staatliches Museum für Naturkunde, Stuttgart.                                         |
| TM   | Transvaal Museum, Pretoria.                                                           |
| UM   | University Museum, Oxford.                                                            |
| ZSBS | Zoologische Sammlung des Bayerischen Staates, Munich.                                 |

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Dr L. A. Berger of the Musée Royal de l'Afrique Centrale for the loan of nearly all the *Zamarada* known from Zaire and from Rwanda and Burundi; Dr R. H. Carcasson, previously of the National Museum in Nairobi, for the loan of extensive East African material, mostly of his own collecting; Dr Harry K. Clench of the Carnegie Museum in Pittsburgh for the loan of the very rich collection of Cameroun *Zamarada* and for most generously placing at my disposal a provisional key to the Cameroun species which he had prepared; Dr A. Diakonoff of the Rijksmuseum van Natuurlijke Historie in Leiden for the loan of Snellen syntypes and extensive

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#### TREATMENT

Previously known species are re-described in the same style as those species described for the first time, the same basic pattern of description being followed throughout the paper. The colour names used in the descriptions are taken from the *Methuen Handbook of Colour* (1967); all the plate numbers cited in parentheses after colour names refer to this work.

The wing measurements given represent the range of wing length from the smallest to the largest of each sex; the measurement is of the fore wing from mid-thorax to apex. The antennal measurements are those of the longest pectinations, at about mid-shaft; these are related to the diameter of the shaft.

The genitalia of both sexes, when known, are described and illustrated. Drawings of fabricated male and female genitalia illustrate the range of characters referred to in the descriptions (Text-figs 2-4). Drawings for most of the text-figures have been prepared by Mr Arthur Smith, A.R.C.A. and Mrs Maureen Lane; others have been prepared by Mrs Janet Adams, Mr Alan Palmer, Mrs Kathleen H. Smiles, Miss Sally A. Sharpe and by the author. The initials of the artists who prepared the drawings are included in parentheses in the legends. The scale placed by each drawing represents one millimetre. The half-tone illustrations of the moths and of the female genitalia have been prepared from photographs taken by Mr J. Brown and Mr P. York of the Photographic Section of the British Museum (Natural History).

A key to the species-groups based on characters of the male genitalia precedes the taxonomic part of the work; keys to species level are provided after each species-group heading in the text. The female genitalia do not appear to show characters for the separation of species-groups; a key to species level using these structures



would involve lengthy descriptions of the shape of the sterigma and its parts, which can be better understood from the illustrations provided.

Bibliographic references appearing in the text and in the synonymy are given in abbreviated form. A full bibliography appears at the end of the revision.

In examining the species previously described in *Zamarada*, a number have been found to belong to other genera. These are listed after the check-list of included species, together with their new binomina. For the sake of completeness, those species already transferred from *Zamarada* by other authors have been included with a reference to the first publication of the new binomen.

### ZAMARADA Moore

*Zamarada* Moore, 1887 : 432. Type-species: *Zamarada translucida* Moore, by monotypy.

Proboscis well developed. Frons smoothly scaled. Antennae of both sexes bipectinate to between one-half and two-thirds of the length of the shaft, the pectinations decreasing in length apicad. Fore tibia with epiphysis; mid tibia with one pair of terminal spurs; hind tibia of male sometimes dilate, enclosing a dense tuft of hair-scales, both sexes with two pairs of spurs. Fore wing without fovea; termen weakly curved from apex to tornus; termen of hind wing boldly and smoothly curved. Proximal two-thirds of each wing hyaline and translucent, usually tinged with yellow or green; costa of fore wing fully scaled; distal third of each wing patterned, but with hyaline area usually intruding, sometimes to termen, between veins  $M_3$  and  $Cu_{1b}$ . Venation, varying very little, as illustrated (Text-fig. 1); in the fore wing vein  $R_3$  is absent.

*Male genitalia.* Uncus variable in form; usually tapered and setose dorsally (Text-fig. 13), but may form a cowl-like structure (Text-fig. 79) or may be bilobate and symmetrical (Text-figs 439, 441) or bilobate and asymmetrical (Text-figs 443, 445). Ventral plate of gnathus usually developed, but wanting in some species-groups. Valve with long, slender process arising free from base of dorsal margin; process usually has a short, setose projection in basal fourth; in some species-groups sclerotized projections or ornamentations are situate between one-half and three-fourths. Outer surface of valve with an inflatable, densely long-haired corema at base (Pl. 94, fig. 836). Aedeagus with a supporting process, or fulcrum, arising from near base of ventral surface; the fulcrum may be vestigial, as in *denticulata* (Text-fig. 90) in the *baliata*-group and as in species in the *scriptifasciata*-group, it may be long and slender, twice as long as the aedeagus, as in the *acrochra*-group (Text-fig. 340) or bifid as in the *vulpina*-group (Text-fig. 253). Vesica with or without cornuti.

*Female genitalia.* Sterigma usually sclerotized, sometimes asymmetrical. Corpus bursae usually sclerotized posteriorly. Serrate-edged semi-circular or stellate signum present in all species, except the *Mascarene aureomarginata* Pagenstecher and *griveaudi* sp. n., in which a signum is wanting.

*Zamarada* is a distinctive Old World genus, recognized by the pattern combination of proximal hyaline and terminal fully-scaled wing areas and by the presence in the male genitalia of a fulcrum-like, supporting process attached to the ventral surface of the aedeagus. The only similarly-patterned Old World species with which *Zamarada* might be confused are *P. xanthyla* (Hampson) (1896 : 553) and *P. oblectata* Prout (1929 : 48) currently included in the genus *Peratophyga* Warren (1894 : 407). These species differ from *Zamarada* in the shape of the hind wing, which is angled at vein  $M_3$ ; in the venation of the fore wing in which all radial veins are present; in the presence of a fovea on the fore wing of the male and of ciliate antennae in the female and in the absence of a fulcrum in the male genitalia.

**AFFINITIES.** *Zamarada* is one of several structurally similar Old World genera in which there is a long, slender process arising free from the base of the dorsal margin of the valve.

*Peratophyga* Warren (1894 : 407), as currently composed, includes in addition to the typical species-group, two species, *xanthyla* (Hampson) (1896 : 553) from India and Malaya and *oblectata* Prout (1929 : 48) from Ceram, which resemble *Zamarada* in their wing pattern, the proximal two-thirds of each wing being hyaline and the distal third fully scaled and patterned. Both typical *Peratophyga* and the species *P. xanthyla* and *P. oblectata* may be distinguished from *Zamarada* by their venation, by the presence of a fovea on the fore wing of the male and by the antennal structure. In the fore wing all radial veins are present, veins  $R_2 - R_4$  are on a common stalk arising from the radius before the upper angle of the cell and  $R_5 + M_1$  are long-stalked from the upper angle; the female antennae are ciliate. In typical *Peratophyga* the wings are fully scaled and the male antennae are also ciliate.

The two species *xanthyla* and *oblectata* and two undescribed species from Sarawak, Labuan, Bangkwa Island and Celebes probably need a separate genus, differing from the type-species of *Peratophyga* (*Idaea hyalinata* Kollar, 1844 : 491) and other species included in the genus in wing pattern and antennal structure and in modifications of both male and female genitalia. The wing pattern and male antennae resemble those of *Zamarada*, but the hind wing is angled at vein  $M_3$ .

The Palaearctic *Stegania* Guenée (1845 : 270) (= *Lomographa* sensu auct.) and *Ninodes* Warren (1894 : 407) each have venation similar to that of *Zamarada*, but in both genera a fovea is present on the fore wing in the male and the wings are fully scaled. In *Stegania* the male antennae are pectinate; the female antennae of *Stegania* and the antennae of both sexes of *Ninodes* are ciliate.

*Euctenostega* Prout (1916a : 38), a monotypic genus from Sarawak, differs from *Zamarada* in venation and in having fully scaled wings; the antennae of both sexes are bipectinate. In the venation, which is similar to that of *Peratophyga*, all radial veins are present, veins  $R_2 - R_4$  are on a common stalk arising from three-fourths radius and  $R_5 + M_1$  arise from a point at the upper angle of the cell.

*Cassyma* Guenée (1857a : 17), *Ingena* Walker (1863 : 1571) and *Chrostobapta* sensu Warren (1909a : 127), represented throughout the Oriental region and extending into the Palaearctic region in Japan, share with *Zamarada* a similar venation and the absence of a fovea on the fore wing of the male. The wings are fully scaled, however, and the antennae of both sexes are ciliate. In the male genitalia of each type-species a pair of strongly sclerotized processes (furca of Pierce, 1914) extends between the valves from base almost to uncus; the coremata on the valves are well developed.

The monotypic Oriental genus *Pristostegania* Warren (1897 : 81) has fully scaled wings and differs from *Zamarada* in venation. On the fore wing, vein  $M_1$  is from the upper angle of the cell and vein  $M_2$  arises from nearer to  $M_1$  than to  $M_3$ ; a fovea is present in the male. The antennae of both sexes are ciliate.

*Deuterostegane* Wehrli (1939 : 294), a monotypic genus represented in S. China, has fully scaled wings and venation similar to that of *Zamarada*; the antennae of both sexes are ciliate.

*Hydatocapnia* Warren (1895 : 143), represented in the Oriental region from N. India to Java and Celebes, has venation similar to that of *Zamarada*; the wings are fully scaled, a fovea is present on the fore wing in the male and the antennae of both sexes are ciliate. Coremata are present on the valves in the male genitalia.

*Heterostegane* Hampson (1893 : 142) (= *Liposchema* Warren, 1914 : 494), the most widely distributed of those genera closely related to *Zamarada*, occurs throughout the Oriental region, extending south-eastwards to Celebes; it occurs also both in the eastern and western parts of the Palaearctic region and throughout the Ethiopian region. In venation and in the absence of a fovea on the fore wing of the male, the included species are similar to *Zamarada*, but the wings are fully scaled and the antennae of both sexes are ciliate. In the male genitalia the aedeagus is firmly attached by a strongly sclerotized strap-like process to a well developed furca; in the female genitalia the ovipositor lobes are broad and densely setose.

*Chrostobapta* Warren (1907 : 164) is similar in external appearance and structure to *Heterostegane*, differing in modifications of the genitalia of both sexes. The genus is represented in Java, Bali, Larat Island, Kei Islands and New Guinea; gaps in the distribution probably reflect gaps in collecting.

The Ethiopian genus *Xenostega* Warren (1899 : 301), superficially similar to *Heterostegane*, differs from that genus and from *Zamarada* in the proximity of vein  $M_2$  to  $M_1$  on the fore wing and in the presence of a fovea in the male. The antennae of both sexes are bipectinate, but the wings are fully scaled.

The other purely Ethiopian genera, *Pycnostega* Warren (1905 : 393) and *Cacostegania* Warren (1901 : 211), appear to have affinities with *Zamarada*. *Pycnostega* has venation similar to that of *Zamarada* and has well-developed coremata on the valves in the male genitalia. The wings are, however, fully scaled and a fovea is present in the male. The male antennae are bipectinate, those of the female ciliate.

*Cacostegania* has fully scaled wings and differs from *Zamarada* in venation;  $R_1$  in the fore wing anastomoses first with vein *C* and then briefly with  $R_2$ , forming a slender areole. The male is without a fovea. In the male genitalia the aedeagus is attached by a sclerotized strap-like process to the juxta; the coremata on the valves are weakly developed. The antennae of the male are bipectinate, those of the female ciliate.

The neotropical *Zamaradopsis tenera* Warren (1907a : 271) resembles species in the Old World *Zamarada* in having the proximal three-fourths of each wing hyaline and the terminal fourth fully scaled and patterned, but is structurally remote from them.

**DISTRIBUTION.** The genus *Zamarada* occurs throughout the Ethiopian region and is represented by two species in the Palaearctic region and by nine species in the Indian and Malayan subregions of the Oriental region. Ethiopian *Zamarada* extend over the whole of continental Africa south of the Sahara, to the islands in the Gulf of Guinea, to Madagascar and to the Comoro Islands; they extend northwards along the Nile Valley into Egypt, along the eastern side of the Red Sea from Yemen, through western Arabia to Israel and Jordan, thence eastwards through Iran to West Pakistan.



The Indo-Malayan element of the genus ranges from N. India, through Burma, Malaysia and Indonesia as far eastwards as the Tanimbar Islands. This element of the genus includes only nine species, forming two species-groups, contrasting markedly with the rich representation of over 200 species in the Ethiopian region. Both Oriental species-groups show some degree of subspeciation, but are structurally quite remote from any Ethiopian species-group; their isolation is evidently ancient and they may represent a depauperate fauna.

Among the 200 Ethiopian species a number of well-defined species-groups are recognizable; equally there are numerous species which appear to be taxonomically isolated, without any close affinity, perhaps survivors of species-groups reduced to single species by extinction. Data labels on all but very few specimens are inadequate to relate precisely the moths studied to the vegetation zones in which they were taken and the following discussion on their distribution can only be tentative in that respect. Speciation has taken place most richly in the lowland rain forest of the Congo Basin and West Africa, where 65 % of the Ethiopian species occur; of the 139 lowland forest species, 124 are known from the great forested area of Nigeria-Cameroun-Gabon-Congo. Collecting at two stations in the lowland rain forest a few kilometres north of Edea in Cameroun during late March and early April 1970, Monsieur C. Herbulot took over forty species of *Zamarada*; from similar country H. L. Weber collected 64 species at Efulen over a period of twelve years. Dissection of the lowland rain forest by drought conditions in the past has probably afforded the conditions of periodic isolation necessary for such extensive speciation. Some of the forest species now have a discontinuous distribution east of the Congo Basin, being represented by isolated populations in, for example, Bwamba Forest in Western Uganda, the Kakamega district of Western Kenya and at Amani in the Eastern Usambara Mountains in Tanzania. In a number of instances species exhibit geographic variation; the nominate subspecies of *Z. labifera* Prout occurs widely in the lowland rain forest from Guinea to Cameroun and in Zaire, but is represented at Amani by a structurally distinct subspecies. *Z. candelabra* sp. n., *Z. dentigera* Warren and *Z. reflexaria* Walker shew similar patterns.

Only two forest species are recorded from Ethiopia; *Z. melpomene* Oberthür, which has a very wide distribution in Africa, and *Z. excavata* Bethune-Baker. The Ethiopian populations of the latter species have been isolated and become subspecifically distinct.

There is some evidence to suggest that the distribution of several of the West African lowland forest species is limited by the break in the forest belt, the Dahomey Gap, situated approximately between Lagos in Western Nigeria and Accra in Eastern Ghana, and again by the constriction of the lowland forest belt near Kumba in Cameroun, where it is bordered in the north by the montane forest extending along the Bamenda-Banso highlands and in the south by Mount Cameroun. These suggestions are tentative, as the distributional data available may well prove in some instances simply to reflect the distribution of collectors.

Thirty lowland forest species have distributions comparable with that of *Z. melanopyga* Herbulot, which extends from Sierra Leone to Angola.

The distribution of 15 species is comparable with that of *Z. leona* Gaede, which



extends from Sierra Leone to Ghana, but fails to cross the Dahomey Gap into Nigeria. In the case of *Z. regularis* sp. n. the break in the lowland rain forest appears to be a barrier between the nominate subspecies which has a range extending from Guinea to Ghana and the population in Nigeria which is subspecifically distinct (Map 2).

The distribution of a further 28 species fails to extend westwards beyond Cameroun, for example *Z. clenchi* sp. n. and *Z. dilata* sp. n. In the case of *Z. protrusa* Warren the populations east and west of the constriction in the rain forest between the Bamenda-Banso highlands and Mount Cameroun are subspecifically distinct.

The *perlepidata*-group includes an example of the effect of both the break in the lowland rain forest at the Dahomey Gap and of its constriction further east. *Z. perlepidata* Walker extends from Guinea to Ghana and is replaced east of the Dahomey Gap by *Z. terpsichore* Oberthür; the latter species is in turn represented by subspecifically distinct populations east and west of the Cameroun constriction (Map 5).

Five species-groups consisting of nearly 40 species have adapted successfully to the drier conditions of the South African veldt and to the wooded savannah and acacia steppe of the northern subtropics. *Z. torrida* sp. n. occurs widely in the northern subtropics, from Ahaggar in Southern Algeria and Aïr in N.W. Niger to Saudi Arabia, extending thence northwards into Israel and Jordan. *Z. minimaria* Swinhoe extends across the Saharo-Sindian desert from Ahaggar and Aïr to Pakistan (Map 1).

Species in the *fessa*-group and the *bathyscaphes*-group from Katanga, Zambia and Rhodesia are probably associated with the leguminous *Brachystegia* and *Colophospermum* woodlands.

Seven species of *Zamarada* are known from the islands in the Gulf of Guinea. Six species occur on Fernando Po, the island nearest to the mainland; all are lowland forest species and appear to be indistinguishable from their respective mainland populations. Only the endemic *Z. principis* Herbulot is known from Principe Island and no *Zamarada* species is yet known from the two outermost islands, São Tomé and Annobon.

Six species of *Zamarada* are known from Madagascar. *Z. viettei* sp. n. is an endemic species apparently unrelated to any continental species-group. Two species included in the *excavata*-group occur on the island; *Z. oxybeles* sp. n., an endemic species, and an endemic subspecies of *Z. excavata* Bethune-Baker. *Z. calypso* Prout occurs also in Eastern Kenya and in N.E. Ethiopia (Dire Dawa); the continental and the island populations of this species appear to be indistinguishable. In addition to these four forest/woodland species, there are two endemic species of the *minimaria*-group from the dry south-west of the island, *Z. aureo-marginata* Pagenstecher and *Z. griveaudi* sp. n. The varying degree of differentiation between the Madagascan species and those of continental Africa, ranging from the endemic isolate, *Z. viettei* sp. n., to the subspecifically distinct *excavata* suggest that the present population of *Zamarada* results from a number of separate arrivals from continental Africa. There is no evidence to show where *Z. calypso* Prout originated.

*Z. differens* Bastelberger, apparently a savannah species, is the only representative of the genus recorded from the Comoro Islands. The Comoro Island specimen appears to be identical with examples of the species from continental Africa.

No species of *Zamarada* has yet been recorded from Mauritius or from the Seychelles.

**BIOLOGY.** Little is known of the immature stages of *Zamarada*. Singh (1953), who described and figured the chaetotaxy of the larva of *Z. excisa* Hampson under the name *Z. translucida* Moore, records the species as a defoliator of *Cassia fistula* (Leguminosae).

The few other *Zamarada* larvae that have been reared have also fed on leguminous plants. *Z. nasuta* Warren was reared by G. S. Cotterell in Ghana on the foliage of *Dichrostachys cinerea* (Linnaeus) Wight & Arnott (recorded as *Dichrostachys glomeratus* (Forsk.) Chiov.). E. E. Platt (1921 : 131) reared *Z. pulverosa* Warren on the foliage of the same plant; this record appears under the name *Zamarada secutaria* (Guenée) and the host-plant is listed as *Dichrostachys nutans* Benthham, a synonym of *D. cinerea* (Linnaeus) Wight & Arnott. A pupa of *Z. prolata* sp. n. was found on a leaf of *Crotalaria pallida* Aiton in Uganda (recorded on the data label as *Crotalaria striata* DC., a synonym of *C. pallida* Aiton).

A specimen tentatively associated with *Z. chrysopa* sp. n. from Sokoke Forest in Eastern Kenya was reared from a larva that was found on the foliage of an *Ochna* sp. (Ochnaceae). In private communications D. G. Sevastopulo writes 'The larva was found on *Ochna* sp. (Ochnaceae), which rather surprised me as I thought *Zamarada* were *Acacia* feeders. It pupated without feeding further, so *Ochna* may not be the food-plant at all' (29.vi.1969). 'The larva pupated under a very thin, transparent web of silk spun across the trough of the leaf' (19.vii.1969).

A. L. H. Townsend reared a number of species of *Zamarada* at Nakuru in Kenya, but Mr M. J. Clifton has been unable to find any notes relating to them in the Townsend note-books and diaries in the National Museum in Nairobi. In 1937 Townsend (1937 : 128-129) published descriptions of the eggs, larvae and pupae of *Z. ochrata* Warren that he had bred; the larvae were reared on *Acacia* sp. A specimen of *Z. mesotaenia* Prout from his collection dated ix. 1940 was reared on *Acacia* and a specimen of *Z. delta* sp. n. dated 20.ix.1940 was also reared on *Acacia*.

#### CHECK-LIST OF SPECIES INCLUDED IN *Zamarada*

##### **ZAMARADA** Moore

##### *keraia*-group

*keraia* sp. n.

*ekphysis* sp. n.

*inermis* sp. n.

##### *ansorgei*-group

*ansorgei* Warren

##### *minimaria*-group

*minimaria minimaria* Swinhoe

*iranica* Brandt

*minimaria arenosa* subsp. n.

*latilimbata* Rebel

*townsendi* sp. n.

*eurygnathus* sp. n.

*anacantha* sp. n.

*aureomarginata* Pagenstecher

*griveaudi* sp. n.

*phaeozona* Hampson

*labrys* sp. n.

*mesotaenia* Prout stat. n.

*consecuta* Prout

*deceptrix* Warren

*delosis* sp. n.

*pulverosa*-group

- chrysothyra* Hampson  
*secutaria* (Guenée)  
*amicta* Prout  
*ordinaria* Bethune-Baker  
     *medianata* Prout **syn. n.**  
*metallicata* Warren  
*erugata* sp. n.  
*prionotos* sp. n.  
*pulverosa* Warren  
*ascaphes* Prout  
*torrida* sp. n.  
*tosta* sp. n.  
*delta* sp. n.  
*psammites* Fletcher  
*hyalinaria* (Guenée)  
*ochrata* Warren  
*melasma* sp. n.  
*ilma* Prout  
     *opposita* Prout **syn. n.**

*differens*-group

- differens* Bastelberger  
     *pandatilinea* Prout  
*jansei* sp. n.

*scriptifasciata*-group

- scriptifasciata* (Walker)  
*baliata* (Felder) sp. rev.  
     *translucida* Moore **syn. n.**  
*fugax* Warren  
*symmetra* sp. n.  
*excisa* Hampson sp. rev.  
*denticulata* sp. n.

*eogenaria*-group

- eogenaria eogenaria* (Snellen)  
*eogenaria cosmiaria* Swinhoe  
     *tenuimargo* Swinhoe  
*nesiotica* sp. n.  
*ucata* sp. n.

*flavicosta*-group

- flavicosta* Warren  
*indicata* sp. n.  
*regularis regularis* sp. n. et subsp. n.  
*regularis arcuata* subsp. n.  
*schalida* sp. n.

*excavata*-group

- pringlei* sp. n.  
*dentata* Fletcher  
*psectra* sp. n.  
*excavata excavata* Bethune-Baker  
*excavata acis* subsp. n.  
*excavata pollex* subsp. n.  
*episema* sp. n.  
*dasysceles* sp. n.

- laciniata* sp. n.  
*dyscapna* sp. n.  
*radula* sp. n.  
*cinereata* sp. n.  
*fusticula* sp. n.  
*sicula* sp. n.  
*manifesta* sp. n.  
*dargei* sp. n.  
*hero* Prout  
*corymbophora* sp. n.  
*aclys* sp. n.  
*thalia* Oberthür  
*astales* sp. n.  
*pentthesis* sp. n.  
*melpomene* Oberthür  
     *tragodica* Prout **syn. n.**  
*incompta* sp. n.  
*setosa* sp. n.  
*oxybeles* sp. n.  
*subinterrupta* Gaede  
*lophobela* sp. n.

*protrusa*-group

- protrusa protrusa* Warren  
*protrusa serrula* subsp. n.  
*sinecalcarata* sp. n.  
*lanceolata* sp. n.  
*disparata* sp. n.  
*carcassoni* sp. n.  
*bernardii* sp. n.  
*antimima* sp. n.  
*strigilecula* sp. n.  
*ferruginata* sp. n.  
*arguta* sp. n.  
*dentigera dentigera* Warren  
     *polymnia* Oberthür  
*dentigera stenotes* subsp. n.  
*chrysopa* sp. n.  
*fibulata* sp. n.  
*urania* Oberthür  
*melanopyga* Herbulot  
*ostracodes* sp. n.  
*aglae* Oberthür  
*ariste* sp. n.  
*phoenopasta* sp. n.  
*cautela* sp. n.  
*miranda* sp. n.

*viettei*-group

- viettei* sp. n.

*cepa*-group

- cepa* sp. n.

*xystra*-group

- xystra* sp. n.  
*similis* sp. n.

**ilaria-group***ilaria* Swinhoe*erato* Oberthür **sp. rev.****gaedei-group***gaedei* **sp. n.****polycytemon-group***transvisaria* (Guenée)*exarata* (Felder)*amelga* **sp. n.***calypso* Prout*iobathra* Prout*euryscaphes* Prout*polycytemon* Prout**bathyscaphes-group***bathyscaphes* Prout*perplexa* Janse **syn. n.***adiposata* (Felder)*odontophora* **sp. n.***aequilumata* **sp. n.***aclea* Prout*angustimargo* Warren*psi* **sp. n.****purimargo-group***purimargo* Prout*viridiceps* Prout **syn. n.****dilucida-group***dilucida* Warren**lepta-group***lepta* **sp. n.***suda* **sp. n.****nasuta-group***nasuta* Warren**vulpina-group***vulpina* Warren*erna* Strand **syn. n.***longidens* Fletcher*bastelbergeri* Gaede*acichemena* Prout **syn. n.***dialitha* **sp. n.***saburra* **sp. n.****candelabra-group***candelabra candelabra* **sp. n. et subsp. n.***candelabra flexura* **subsp. n.***exigua* **sp. n.***prolata* **sp. n.****ignicosta-group***ignicosta ignicosta* Prout*ignicosta pyrilampes* Prout*hemimeres* Prout*ignicosta hamulata* **subsp. n.****scintillans-group***scintillans* Bastelberger*flavicincta* Hampson*flavicaput* Warren*pyrocincta* Hampson **syn. n.***gracilata* **sp. n.****euphrosyne-group***euphrosyne* Oberthür**rufilinearia-group***rufilinearia* Swinhoe*caliope* Oberthür**kompsotes-group***kompsotes* **sp. n.****fessa-group***denticatella* Prout*densisparsa* Prout*fessa* Prout*eroessa* Prout*euterpina* Oberthür **sp. rev.***dorsiplaga* Prout**metrioscaphes-group***metrioscaphes* Prout*seydeli* **sp. n.***glareosa* Bastelberger*laborae* Strand **syn. n.***nebulimargo* Prout*euterpe* Oberthür*rubrifascia* Pinhey*plana plana* Bastelberger*plana denticincta* Hampson*varii* **sp. n.***astyphele* **sp. n.***griseola* **sp. n.***euerces* Prout*phygas* Prout **syn. n.***geitaina* **sp. n.***phrontisaria* Swinhoe*fumosa* Gaede*flava* Gaede*cathetus* **sp. n.***unisona* **sp. n.****acosmeta-group***acosmeta* Prout*pinheyi* Fletcher**dione-group***dione* **sp. n.****labifera group***labifera labifera* Prout*labifera discata* **subsp. n.****cydippe-group***cydippe* Herbulot*adumbrata* **sp. n.**



- acrochra*-group  
*dilata* sp. n.  
*enippe* Prout  
*clenchi* sp. n.  
*acrochra* Prout  
*auratisquama* Warren
- undimarginata*-group  
*corroborata* Herbulot  
*undimarginata* Warren
- principis*-group  
*principis* Herbulot  
*platycephala* sp. n.  
*tricuspidata* sp. n.  
*clavigera* sp. n.  
*bilobata* sp. n.  
*bicuspidata* sp. n.  
*consummata* sp. n.  
*onycha* sp. n.  
*rupta* sp. n.  
*merga* sp. n.  
*lima* sp. n.  
*gamma* Fletcher  
*subincoloris* Gaede  
*xyele* sp. n.
- aurolineata*-group  
*clio* Oberthür  
*aurolineata* Gaede  
*aerata* sp. n.  
*herbuloti* sp. n.
- perlepidata*-group  
*bonaberiensis* Strand  
*collarti* Debauche  
*vigilans* Prout  
*perlepidata* (Walker)  
*exquisita* Warren  
*terpsichore terpsichore* Oberthür  
sp. rev.  
*terpsichore compacta* subsp. n.  
*terpsichore aprica* subsp. n.  
*dolorosa* sp. n.
- reflexaria*-group  
*rhamphis* sp. n.  
*cucharita* sp. n.
- reflexaria reflexaria* (Walker)  
*reflexaria aphis* subsp. n.  
*ixiaria* Swinhoe
- triangularis*-group  
*triangularis* Gaede  
*amymone* Prout  
*crenulata* sp. n.  
*erosa* sp. n.
- pristis*-group  
*pristis* sp. n.  
*anna* sp. n.
- crystallophana*-group  
*crystallophana* Mabilie
- latimargo*-group  
*latimargo* Warren  
*funebria* Gaede syn. n.  
*janata* sp. n.  
*leona* Gaede
- emaciata*-group  
*emaciata* sp. n.
- tullia*-group  
*tullia* Oberthür  
*thalia* Oberthür  
*tullia* Strand  
*thalysia* Gaede  
*sagitta* sp. n.
- paxilla*-group  
*paxilla* sp. n.
- tortura*-group  
*tortura* sp. n.  
*pelobasis* sp. n.
- catori*-group  
*catori* Bethune-Baker
- eucharis*-group  
*eryma* sp. n.  
*eucharis* (Drury)  
*volSELLa* sp. n.  
*deformata* sp. n.  
*mimesis* sp. n.  
*variola* sp. n.  
*opala* Carcasson
- weberi*-group  
*weberi* sp. n.

SPECIES TRANSFERRED FROM *Zamarada* TO OTHER GENERA

- Cacostegania confusa* (Warren, 1901 : 212), **comb. n.** Transferred by L. B. Prout, but transfer not published.
- Peratophyga ionephela* (Wiltshire, 1966 : 148, pl. 12, fig. 17), **comb. n.**
- Stegania lepidota* (Prout, 1916a : 39), **comb. n.** Closely related to the Malaysian

*S. tenebrosa* (Swinhoe, 1902 : 605); both species will probably require a new genus after further study.

*Hydatocapnia marginata* (Warren, 1893 : 388, pl. 32, fig. 22). Transferred by Warren (1895 : 143).

*Peratophyga xanthiyala* (Hampson, 1896 : 553). Transferred by L. B. Prout (1926a : 193).

KEY TO SPECIES-GROUPS BASED ON MALE GENITALIA

- 1 Dorsal process of valve dilate and wholly membranous at apex . . . . . 2
- Dorsal process of valve tapered to narrowly rounded apex or finely tapered and tipped with a hook-like spine; or bearing a tapered or spatulate projection in apical fourth; or serrate-edged in apical half . . . . . 3
- 2 (1) Dorsal processes symmetrical, dilate and evenly rounded at apices (Text-fig. 5), similar to those found in genus *Semiothisa* . . . . . *keratia*-group (p. 22)
- Dorsal processes asymmetrical, apical margins shallowly excavate. Valves asymmetrical. Uncus bilobate . . . . . *weberi*-group (p. 265)
- 3 (1) Dorsal process of valve little tapered, apex rounded, not tipped with a spine. Valves usually asymmetrical . . . . . 4
- Dorsal process of valve not so formed . . . . . 6
- 4 (3) Dorsal process straight, densely and slenderly spined apicad. Valves asymmetrical. Fulcrum dilate and spiral in apical half, one margin densely scobinate (Text-fig. 243). Vesica without cornuti . . . *purimargo*-group (p. 143)
- Dorsal process curved or angled through 90 degrees in apical third; valves symmetrical or asymmetrical . . . . . 5
- 5 (4) Dorsal process curved through 90 degrees and finely setose in apical third; valves asymmetrical. Juxta boldly bilobate at apex. Fulcrum subequal in length to aedeagus, narrowly rounded at apex; vesica without cornuti . . . *nasuta*-group (p. 148)
- Dorsal process angled through 90 degrees and coarsely spined in apical third; valves symmetrical or asymmetrical. Fulcrum slender basad, apex dilate to partly enfold aedeagus; vesica with cluster of cornuti . . . *bathyscaphes*-group (p. 136)
- 6 (3) Dorsal process ornamented with digitate, spatulate or spined projections; or serrate-edged; or with serrate-edged projection in apical half; basal fourth simple without setose projection or dilation; valves simple, membranous or weakly sclerotized and symmetrical, occasionally with a weak, setose ridge parallel with dorsal margin. Vesica with one or more cornuti . . . . . 7
- Dorsal process of valve without ornamentation, but curved or angled to finely tapered apex tipped with a hook-like spine . . . . . 10
- 7 (6) Basal two-thirds of dorsal process of valve straight; a short, spatulate, digitate projection at this point; valve weakly sclerotized, sparsely setose, apex boldly rounded (Text-fig. 261). Vesica with a tapered, scobinate cornutus near apex and a second, transverse cornutus medially . . . *candelabra*-group (part, *candelabra*, *exigua*) (p. 155)
- Dorsal process not so formed; valves wholly membranous, usually slightly narrowed to rounded apex and setose on ventral surface apicad. Cornuti differently formed . . . . . 8
- 8 (7) Aedeagus with stout, tapered projection, smooth-edged or scobinate, from three-fifths. Ventral plate of gnathus weakly sclerotized and smooth, or absent. Dorsal process of valve scobinate for whole length from dilate base to tapered apex (Text-fig. 75), or with large, serrate-edged plate in apical half (Text-fig. 77) . . . . . *differens*-group (p. 62)

- Aedeagus scobinate or smooth, but without tapered projection. Ventral plate of gnathus well developed. Dorsal process of valve not so formed . . . 9
- 9 (8) Dorsal process of each valve with serrate edge or with serrate-edged projection, the two processes symmetrical or asymmetrical (Text-figs 47, 61); or with triangular or spatulate projection at about three-fourths (Text-figs 63, 71). Ventral plate of gnathus produced ventrad, tongue-like in shape, rounded at tip. Aedeagus coarsely scobinate at one side in apical fourth (except *ochrata*). Fulcrum scobinate at tip, longer than aedeagus (except *melasma*); vesica always with one thorn-like cornutus . . . *pulverosa*-group (part) (p. 40)
- Dorsal process with spine-like (Text-fig. 21) or with smooth-, never serrate-edged, angular projection (Text-fig. 35) at about three-fourths. Ventral plate of gnathus sclerotized and well developed, but not produced ventrad in tongue-like form. Aedeagus smooth, or with one surface scobinate; cornuti always multiple, consisting of a cluster of short spines equal in length to width of aedeagus . . . *mimimaria*-group (part) (p. 26)
- 10 (6) Fulcrum bifid, the twin parallel arms blade-like, symmetrical or asymmetrical; or tapered to points and asymmetrical . . . 11
- Fulcrum not so formed . . . 13
- 11 (10) Arms of fulcrum tapered to points and asymmetrical. Tenth sternite and tergite spirally twisted so that uncus is situate ventrally and ventral plate of gnathus situate dorsally . . . *acosmeta*-group (p. 193)
- Arms of fulcrum blade-like . . . 12
- 12 (11) Arms of fulcrum symmetrical, ventral margin of each serrate in basal two-thirds. Inner surface of each valve with inwardly-pointing, peg-like projection at apex . . . *paxilla*-group (p. 254)
- Ventral margin of each arm of fulcrum smooth. Valve simple *vulpina*-group (p. 150)
- 13 (10) Uncus hood-like or bilobate with a pair of pointed processes, symmetrical or asymmetrical, extending from dorsal surface. Valves symmetrical or asymmetrical. Oriental region . . . *eogenaria*-group (p. 70)
- Uncus not so formed and never with processes extending from dorsal surface . . . 14
- 14 (13) Uncus cowl-like with minute, tapered projection from mid-apical margin. Aedeagus scobinate or serrate on one lateral surface. Fulcrum very weakly developed. Vesica with one or more cornuti. Oriental region . . . *scriptifasciata*-group (p. 64)
- Uncus not so formed . . . 15
- 15 (14) Valves symmetrical . . . 16
- Valves asymmetrical . . . 18
- 16 (15) Uncus bilobate or shallowly and narrowly excavate at apex . . . 17
- Uncus not so formed . . . 27
- 17 (16) Uncus broadly and asymmetrically bilobate. Ventral plate of gnathus asymmetrical. Dorsal and ventral margins of each valve slenderly produced, dorsal extension simple and straight, ventral extension scobinate and finely tapered (Text-fig. 445) . . . *eucharis*-group (part, *mimesis*) (p. 259)
- Uncus tapered to shallowly and narrowly excavate apex, ventrad of which projects a blunt, rectangular process. Ventral plate of gnathus symmetrical, narrowly rounded at apex. Ventral margin of valve minutely produced, dorsal margin strongly produced, scobinate and tapered and inclined towards uncus . . . *principis*-group (part, *lima*) (p. 209)
- 18 (15) Valves incurved and tapered, each to a point, that on left side finely and sharply; dorsal margin of left valve usually scobinate, that of right valve serrate in part. Apex of uncus excavate medially or short and tapered. Fulcrum not scobinate. Third abdominal sternite with transverse band of spines . . . *aurolineata*-group (p. 221)
- Valves not so formed . . . 19

- 19 (18) Uncus with a pair of lateral, rounded, dorsally setose processes. Valve with a coarsely spined ridge along apical half of central margin; a second, shorter ridge nearer apex, usually asymmetrical (Text-fig. 416) *crystallophana*-group (p. 245)
- Uncus and valves not so formed . . . . . 20
- 20 (19) Apex of uncus bilobate or apical margin of uncus excavate. Ventral plate of gnathus strongly sclerotized, usually asymmetrical . . . . . 21
- Apex of uncus not so formed . . . . . 22
- 21 (20) Lobes of uncus symmetrical and evenly rounded . . . . . *tortura*-group (p. 255)
- Lobes of uncus symmetrical or asymmetrical; if symmetrical, then each lobe spatulate and tapered at outer apical angle . . . *eucharis*-group (part) (p. 259)
- 22 (20) Fulcrum less than one-half as long as aedeagus, apex simple. . . . . 23
- Fulcrum at least three-fourths as long as aedeagus, apex scobinate . . . . . 24
- 23 (22) Apex of left valve finely tapered, that of right valve rounded and spatulate. Ventral margin of aedeagus scobinate in apical fourth, without other projection. Vesica without cornuti . . . . . *emaciata*-group (p. 250)
- Apex of left valve with tuft of long, strong setae. Apical fourth of aedeagus with semi-circular, blade-like projection. Vesica with cluster of short, arcuate cornuti . . . . . *euphrosyne*-group (p. 166)
- 24 (22) Fulcrum more than one and three-fourths as long as aedeagus, apex arcuate, curved through 90-180 degrees and finely scobinate. Outer surface of curved, apical part of dorsal process of valve shortly and coarsely setose *cydippe*-group (p. 199)
- Fulcrum less than one and one-half times as long as aedeagus, apex not arcuate. Outer surface of curved, apical part of dorsal process of valve with fine, hair-like setae . . . . . 25
- 25 (24) Right valve truncate at apex, left valve longer, rounded or tapered apicad; each valve with transverse band of long, stout setae on dorsal surface of apical fourth . . . . . *scintillans*-group (p. 162)
- Valves not so formed . . . . . 26
- 26 (25) Uncus long and slender, one-third to one-half as long as aedeagus. Right valve more elaborately developed than left. Apical half of fulcrum coarsely scobinate . . . . . *flavicosta*-group (p. 74)
- Uncus short, broad-based and tapered, less than one-fourth as long as aedeagus, dorsal surface densely and coarsely setose. Apices of valves spine-tipped, left side more elaborately than right . . . *perlepidata*-group (p. 225)
- 27 (16) Uncus with one or two pairs of lateral processes, or with shoulder-like projections at base . . . . . 28
- Uncus without lateral processes or shoulder-like projections at base . . . . . 36
- 28 (27) Uncus with two pairs of lateral processes, the basal pair sclerotized, the apical pair membranous and setose . . . . . *polycitemon*-group (p. 131)
- Uncus with one pair of lateral processes, or with shoulder-like projections at base, either sclerotized or membranous and setose . . . . . 29
- 29 (28) Uncus long, one-third as long as aedeagus, constricted at mid-length; paired lateral processes sclerotized, tapered and inclined caudad. Arms of gnathus fused, but no ventral plate developed . . . . . *gaedei*-group (p. 130)
- Uncus no longer than one-sixth as long as aedeagus; paired lateral processes membranous and setose. Ventral plate of gnathus well developed . . . . . 30
- 30 (29) Ventral plate of gnathus asymmetrical. Greyish yellow hyaline area of each wing immaculate; terminal non-hyaline area dark grey and bright reddish orange . . . . . *rufilinearia*-group (p. 168)
- Ventral plate of gnathus symmetrical. Wings not so coloured . . . . . 31
- 31 (30) Lateral processes of uncus tapered and inclined caudad. Valve tapered and



- inclined towards uncus, apical area and margin scobinate; setose projection from basal fourth of dorsal process of valve long and slender (Text-fig. 351)
- principis*-group (part, *tricuspidata*) (p. 209)
- Lateral processes of uncus rounded, or slight and inclined laterally. Valve differently formed . . . . . 32
- 32 (31) Lateral processes of uncus rounded. Valve with a coarsely spined ridge along apical half of ventral margin; a second, shorter ridge nearer apex, sometimes symmetrical; setose projection from basal fourth of dorsal process of valve long and slender (Text-fig. 416) . . . . . *crystallophana*-group (p. 245)
- Valve not so formed . . . . . 33
- 33 (32) Apical half of uncus slender, basal half dilate laterally and setose. Fulcrum extending to tip of aedeagus, scobinate at apex . . . . . 34
- Uncus triangular, with short, setose, shoulder-like projections. Apical area of valve tapered and scobinate on inner surface, ventral margin slightly produced. Fulcrum atrophied, little longer than width of aedeagus (Text-fig. 425) . . . . . *tullia*-group (part, *tullia*) (p. 251)
- 34 (33) Valve tapered, narrowed by one-half from base to rounded apex (Text-fig. 435). Vesica without cornuti . . . . . *catori*-group (p. 257)
- Valves with apical processes. Vesica with a cluster of short cornuti . . . . . 35
- 35 (34) Dorsal and ventral apices of each valve each with a smooth, digitate, sclerotized process (Text-fig. 403) . . . . . *reflexaria*-group (part, *ixiaria*) (p. 233)
- Dorsal apex of each valve with two tapered, sclerotized processes, smooth or scobinate; ventral apex with one sclerotized and one short, membranous process (Text-figs 413, 415) . . . . . *pristis*-group (p. 243)
- 36 (27) Uncus spatulate and rectangular; or little tapered apicad, the apical margin being truncate and straight-edged. Apical margin of ventral plate of gnathus arcuate or bilobate (Text-figs 347, 349)
- principis*-group (part, *principis*, *platycephala*, *xyele*) (p. 209)
- Uncus not so formed . . . . . 37
- 37 (36) Uncus tapered to truncate apex, apical margin not less than one-half width of base; a short, peg-like projection extends from ventral surface of apical margin. Ventral plate of gnathus well developed and strongly sclerotized, apex rounded
- principis*-group (part, *onycha*, *bicuspidata*, *gamma*, *consummata*) (p. 209)
- Uncus not so formed . . . . . 38
- 38 (37) Uncus almost circular with knobbed, ventral projection (Text-fig. 353). Ventral plate of gnathus with a pair of strongly sclerotized, drumstick-like projections extending caudad. . . . . *principis*-group (part, *clavigera*) (p. 209)
- Uncus simple, tapered to a point or to a blunt or a rounded apex; dorsal surface sometimes with a keel-like ridge, often densely setose . . . . . 39
- 39 (38) Fultura superior sclerotized medially. Ventral plate of gnathus not developed. 40
- Fultura superior wholly membranous . . . . . 41
- 40 (39) Fultura superior coarsely scobinate. Valve tapered to sharply pointed apex; a short, spine-like projection from mid-dorsal margin; inner surface smooth. Vesica with one or more cornuti . . . . . *xystra*-group (p. 126)
- Fultura superior minutely and densely scobinate. Valve tapered to sharply pointed apex, or apices of both dorsal and ventral margins bearing each a short spine at tip (Text-figs 286, 290); inner surface of valve with numerous parallel, sclerotized ridges in apical half. Vesica without cornuti
- fessa*-group (p. 170)
- 41 (39) Heavily sclerotized medial core of fulcrum acicular or tipped with two or three spines; apical third or fourth curved through 90 degrees to point at five-sixths aedeagus, the membranous or weakly sclerotized sheath of

fulcrum extending beyond apex of aedeagus (Text-fig. 401). Valves sclerotized, apices tapered, broadly rounded or very shallowly excavate  
*reflexaria*-group (part) (p. 233)

- Fulcrum not so formed . . . . . 42
- 42 (41) Aedeagus without projecting processes, smoothly edged, or scobinate on only a very small area of either ventral or lateral surface; fulcrum less than two-thirds as long as aedeagus, simple, apex without scobination. Vesica without cornuti . . . . . 43
- Aedeagus and fulcrum not so formed. . . . . 45
- 43 (42) Fulcrum a little more than one-half as long as aedeagus (ratio 7 : 13); aedeagus coarsely scobinate on one lateral surface in apical third (Text-fig. 342). Valve smoothly sclerotized with simple, longitudinal, medial ridge; apex spatulate and rounded, incurved towards uncus  
*acrochra*-group (part, *auratisquama*) (p. 201)
- Fulcrum one-sixth as long as aedeagus . . . . . 44
- 44 (43) Apical area of valve tapered and scobinate on inner surface, ventral margin slenderly produced in digitate form; a scobinate ridge at three-fourths ventral margin. Uncus triangular with short, setose, shoulder-like projections (Text-fig. 425) . . . . . *tullia*-group (part, *tullia*) (p. 251)
- Valve very slender, equal in width to dorsal process, slightly dilate and spined at apex (Text-fig. 281) . . . . . *kompsores*-group (p. 170)
- 45 (42) Fulcrum long, slender and tapered to finely scobinate apex, one and three-fourths to twice as long as aedeagus. Valve smoothly sclerotized with simple longitudinal, medial ridge; apex spatulate and rounded, incurved towards uncus . . . . . *acrochra*-group (part) (p. 201)
- Fulcrum not so formed . . . . . 46
- 46 (45) Apex of valve cleft, bifurcate or bilobate with distinct processes from apices of both dorsal and ventral margins; setose projection at base of dorsal process of valve present . . . . . 47
- Apex of valve not so formed . . . . . 54
- 47 (46) Valve with two processes from apex of dorsal margin, both tapered and sclerotized, either smooth or scobinate, and two processes from apex of ventral margin, one tapered and sclerotized, one short and membranous  
*pristis*-group (p. 243)
- Valve with a single process from apex of each margin . . . . . 48
- 48 (47) Uncus long, one-fourth as long as aedeagus, slender and blunt-tipped. Process at apex of dorsal margin of valve lobate, that at apex of ventral margin tapered (Text-figs 326, 328) . . . . . *labifera*-group (p. 197)
- Uncus and valve not so formed . . . . . 49
- 49 (48) Apical processes spatulate and smoothly sclerotized; ventral apical process rounded, dorsal apical process tapered and blade-like (Text-fig. 403). Uncus slender in apical half, basal half dilate and laterally setose  
*reflexaria*-group (part, *ixiaria*) (p. 233)
- Apical processes not so formed. Uncus simple and tapered, dorsally setose. 50
- 50 (49) Ventral third of valve tapered to setose apex; dorsal two-thirds strongly sclerotized and produced in arcuate form curving towards uncus, apical margin evenly serrate (Text-fig. 345) . . . . . *undimarginata*-group (p. 207)
- Processes from both dorsal and ventral apices sclerotized and otherwise formed . . . . . 51
- 51 (50) Dorsal apical process tapered, margins often crenulate, sometimes reduced to a crenulate stub; ventral apical process smoothly edged, truncate or narrowly rounded at tip (Text-fig. 405). Aedeagus tapered. Fulcrum slender, longer than aedeagus, the finely scobinate apex of sclerotized core extending beyond sheath . . . . . *triangularis*-group (p. 239)

- Both dorsal and ventral sclerotized, apical processes tapered . . . . . 52
- 52 (51) Fulcrum longer than aedeagus, apex coarsely scobinate. Setose projection at base of dorsal process of valve long, slender and digitate. . . . . 53
- Fulcrum shorter than aedeagus, apex tapered to sclerotized point. Setose projection at base of dorsal process of valve short and blunt; sclerotized processes at apices of dorsal and ventral margins smooth (Text-fig. 267) *ignicosta*-group (p. 159)
- 53 (52) Ventral apical process of valve acicular; dorsal apical process broader-based, margins minutely serrate to tapered apex. Aedeagus acicular (Text-figs 366, 367) . . . . . *principis*-group (part, *merga*) (p. 209)
- Apical margin of valve shallowly excavate, dorsal and ventral apices pointed (Text-fig. 314). Aedeagus with two smoothly rounded projections at two-thirds, one digitate, one semi-circular. *metrioscaphes*-group (part, *fumosa*) (p. 176)
- 54 (46) Dorsal margin of valve produced in digitate form, the extension longer than the basal part from which it arises; dorsal process of valve without setose projection at base (Text-fig. 13). Third abdominal sternite with transverse row of spines . . . . . *ansorgei*-group (p. 25)
- Valve not so formed. Third abdominal sternite without transverse row of spines . . . . . 55
- 55 (54) Apex of valve truncate; a longitudinal, medial ridge in apical half terminating in a cluster of coarse spines just before apex. Tapered uncus bulbous at base (Text-fig. 209). Underside of hind wing in male densely clothed in specialized scaling in non-hyaline terminal area . . . . . *cepa*-group (p. 125)
- Apical area of valve not so formed. Hind wing in male without specialized scaling on underside . . . . . 56
- 56 (55) Apical third of valve narrowed to width of apical half of fulcrum, apex spatulate and narrowly rounded; membranous projection at base of dorsal process gross and setose (Text-fig. 246) . . . . . *lepta*-group (part, *lepta*) (p. 145)
- Valve not so formed . . . . . 57
- 57 (56) Apical third of valve spatulate, curved through almost 90 degrees towards uncus, apex rounded; setose, membranous projection at base of dorsal process almost as large as apical third of valve (Text-fig. 248) *lepta* group (part, *suda*) (p. 145)
- Valve not so formed . . . . . 58
- 58 (57) Vesica bearing al arge, arcuate cornutus, the tapered apex barbed; aedeagus with twin lobate, slightly asymmetrical projections at mid-ventral surface. Valve membranous, apex rounded (Text-figs 244, 245). Wings without discal spots . . . . . *dilucida*-group (p. 144)
- Aedeagus and vesica not so formed . . . . . 59
- 59 (58) Arms of gnathus fusing medially to form a clearly defined, strongly sclerotized ventral plate . . . . . 60
- Arms of gnathus tapered and joined by weakly sclerotized transverse band, or joined only by membrane; no ventral plate formed . . . . . 70
- 60 (59) Vesica with one or more cornuti . . . . . 61
- Vesica wholly membranous without cornuti, or in part minutely scobinate . . . . . 63
- 61 (60) Vesica with one cornutus . . . . . 62
- Vesica with a cluster or several cornuti, each cornutus equal in length to width of aedeagus. Valve membranous; occasionally a longitudinal, setose ridge parallel with dorsal margin is present; dorsal process without setose projection at base *minimaria*-group (part, *aureomarginata*, *griveaudi*, *anacantha*, *phaeozona*) (p. 26)
- 62 (61) Aedeagus smooth, or scobinate on dorsal surface in apical fourth; fulcrum extending well beyond tip of aedeagus, apex weakly scobinate. Valves

- wholly membranous; dorsal process dilate at two-thirds, without setose projection at base . . . *pulverosa*-group (part, *hyalinaria*, *ochrata*) (p. 40)
- Aedeagus with digitate projection at three-fourths; fulcrum not extending beyond aedeagus, dilate and coarsely spined at apex. Valve sclerotized; dorsal process evenly tapered, with setose projection near base. Madagascar only . . . *vietteii*-group (p. 124)
- 63 (60) Aedeagus with one or two lobate projections, with digitate projections with rounded apices, or with a well developed, tapered projection at one-half to two-thirds of its length . . . 64
- Aedeagus tapered, without projection . . . 67
- 64 (63) Fulcrum shorter than aedeagus, extending to no more than five-sixths of its length . . . 65
- Fulcrum extending to or beyond tip of aedeagus . . . 66
- 65 (64) Fulcrum five-sixths as long as aedeagus; apical fourth of sclerotized core compressed laterally, dorsal surface nearest to aedeagus coarsely serrate; aedeagus finely tapered, apical fourth scobinate dorsally (Text-fig. 419)
- latimargo*-group (part, *latimargo*, *janata*) (p. 246)
- Fulcrum three-fourths as long as aedeagus and very slender, tip inclined towards aedeagus and minutely scobinate; aedeagus finely tapered, not scobinate (Text-fig. 426). Valve with short, coarsely scobinate ridge at two-thirds ventral margin (Text-fig. 425) . . . *tullia*-group (part, *sagitta*) (p. 251)
- 66 (64) Dorsal process of valve without setose projection near base. Fulcrum with asymmetrical, lateral, angular projections at one-half; apical half coarsely scobinate . . . *candelabra*-group (part, *prolata*) (p. 155)
- Dorsal process of valve with a blunt, or more usually, a slender, digitate, setose projection near base. Fulcrum tapered, without projection, to coarsely scobinate apex . . . *metrioscaphes*-group (part) (p. 176)
- 67 (63) Fulcrum extending to or beyond tip of aedeagus . . . 68
- Fulcrum five-sixths as long as aedeagus; apical fourth of sclerotized core compressed laterally, dorsal surface nearest to aedeagus coarsely serrate; aedeagus finely tapered, apical fourth scobinate dorsally (Text-fig. 422)
- latimargo*-group (part, *leona*) (p. 246)
- 68 (67) Apex of aedeagus spatulate, narrowly rounded; central core of fulcrum minutely scobinate. Five or six short, stout, heavily sclerotized spines along ventral margin of valve in apical fourth
- metrioscaphes*-group (part, *rubrifascia*) (p. 176)
- Apex of aedeagus finely tapered, rapier-like; fulcrum finely or coarsely scobinate apicad . . . 69
- 69 (68) Ventral plate of gnathus of even width and minutely scobinate, apex broadly rounded, one-third as wide, or less, than base of uncus. Apex of fulcrum finely scobinate . . . *metrioscaphes*-group (part, *plana*, *euerces*) (p. 176)
- Ventral plate of gnathus large and very strongly sclerotized, slightly tapered to rounded apex; width at mid-length one-half to five-sixths of base of uncus. Fulcrum very coarsely spined at apex.
- principis*-group (part, *rupta*, *subincoloris*) (p. 209)
- 70 (59) Apex of ventral margin of valve produced, lobate and setose; dorsal process of valve sharply angled through 90 degrees at three-fifths (Text-fig. 324). Aedeagus with laterally-pointing, thorn-like projection at one-half. No cornutus. . . *dione*-group (p. 196)
- Valve not so formed . . . 71
- 71 (70) Apex of fulcrum dilate and spatulate, dorsal surface densely scobinate and tipped with a stout spine equal in length to width of pad-like, scobinate apex. Aedeagus with narrow, longitudinal, sclerotized ridge bearing a



- laterally-pointing thorn-like projection at three-fourths. No cornutus.  
 Valve membranous . . . . . *ilaria*-group (p. 127)  
 - Fulcrum simply tapered or bearing angular, lateral projections, symmetrical or asymmetrical; apex never scobinate. Aedeagus usually bearing one or more projections, either rod-like and tapered; blade-like and tapered; digitate, smooth or scobinate; or short and truncate, usually extending apicad. Vesica with or without cornuti. If aedeagus is without projection, then vesica always ornamented with one or more cornuti . . . . . 72  
 72 (71) Outer surface of valve fur-like, being densely clothed with short, vertical hair-scales (Pl. 94, fig. 835) . . . . . *protrusa*-group (p. 104)  
 - Outer surface of valve not so scaled . . . . . *excavata*-group (p. 79)

### THE *KERAIA*-GROUP

A group of small East African coastal species with a wing length of 9-11 mm. The male genitalia are characterized by the form of the dorsal process of the valve, which is straight and broad with rounded apex, similar to that found in species of *Semiothisa*. The uncus is tapered, the apex curved ventrad; dorsal surface usually with keel-like ridge, sometimes with digitate projection from base. In *inermis* the uncus is short with a pair of lateral, shoulder-like projections. In the female genitalia the corpus bursae is sclerotized and ribbed.

#### KEY TO SPECIES

- 1 Valve tapered apicad; a tapered process near mid-base. Fulcrum broadened apicad to enfold apex of aedeagus. Vesica with two scobinate cornuti . . . . . 2  
 - Valve simple and of even width to rounded apex. Fulcrum slender and of even width to rounded apex. Vesica with a smooth, acicular cornutus, two-thirds as long as aedeagus . . . . . *inermis* (p. 24)  
 2 (1) Apical margin of valve with two short spines projecting caudad. Aedeagus without projections . . . . . *keraia* (p. 22)  
 - Apex of valve without projecting spines. Aedeagus with spine-like projection at three-fourths . . . . . *ekphysis* (p. 23)

### *Zamarada keraia* sp. n.

(Text-figs 5-8; Pl. 1, figs 455, 456; Pl. 95, figs 837, 838)

♂♀ (Pl. 95, figs 837, 838). Hyaline area of wings greyish yellow (pl. 3, B4-5), irrorate with grey tinged with vinaceous, sparsely in male, moderately in female, and finely edged distally with light yellow (pl. 4, A5), then dark brown and glossy grey; costa of fore wing light yellow; discal spots dark grey; non-hyaline terminal area light yellow, suffused with orange-grey proximally (pl. 5, B2) and sparsely irrorate with orange-grey distally in the male, suffused with orange-grey distally in the female; ill-defined subterminal fascia light brown. Underside of non-hyaline terminal area similar to that of upperside in male, but slenderly marked with greyish brown proximally; fore wing of female uniformly greyish brown, hind wing similar to that of male. Male hind tibia simple.

♂ genitalia (Text-figs 5, 6). Uncus tapered, apex curved ventrad; dorsal surface ridged, with slight projection near base of ridge. Arms of gnathus joined, forming a shallow, ventral plate. Dorsal process of valve straight, apex broadly rounded and setose; apical margin of valve with two short spines projecting caudad; a strongly sclerotized spine, equal in length

to width of valve, extends longitudinally on inner surface of valve from base; in one example the spine is bifurcate on one valve. Fulcrum weakly sclerotized, broadened apicad to enfold apex of aedeagus, but not extending beyond it. Vesica with two scobinate cornuti, one slender, one-half as long as aedeagus, the other short and equal in length to width of aedeagus.

♀ genitalia (Pl. 1, figs 455, 456). Lamella antevaginalis excavate medially, lateral arms broad and spatulate enfolding ostium. Ductus bursae ribbed and weakly sclerotized, about one-half as long as pyriform corpus bursae.

Measurements. Fore wing: ♂ 10–11 mm, ♀ 11 mm. Antennal pectinations: ♂ 17 ×, ♀ 6 × diameter of shaft.

Externally closely similar to *Z. delta* sp. n. in the *pulverosa*-group. The male may be distinguished by the longer epiphysis on the fore tibia; the ratio of epiphysis to tibia in *keriaia* is 6 : 7, in *delta* the ratio is 4 : 7. In the male genitalia the form of the valve and the ornamentation of the vesica and in the female the form of the sterigma are diagnostic.

DISTRIBUTION. Kenya Coast, Shimba Hills.

Holotype ♂, KENYA: Coast, Shimba Hills, xii. 1961 (*R. H. Carcasson*), Geometridae genitalia slide no. 7529 in BMNH.

Paratypes. KENYA: holotype data, 1 ♂, 2 ♀; ibidem, iv. 1964, 1 ♀.

Two closely similar males, collected at Amani in Tanzania in February and March by Dr G. Pringle, differ from the type-series of *keriaia* in the presence of a short, digitate projection from the base of the dorsal surface of the uncus and a short, hook-like projection from the dorsal surface of the aedeagus at three-fourths (Text-figs 7, 8).

### *Zamarada ekphysis* sp. n.

(Text-figs 9, 10; Pl. 1, figs 453, 454; Pl. 95, fig. 839)

♂ ♀ (Pl. 95, fig. 839). Hyaline area of wings weakly tinged with yellowish green, sparsely irrorate with grey along posterior margin of fore wing and finely edged distally with light yellow, then with brown and silvery grey; costa of fore wing light yellow, irrorate with grey tinged with vinaceous; discal spot on fore wing minute, dark grey. Dentate subterminal fascia brown (pl. 6, E6, tan) edged distally with light buff; remainder of non-hyaline terminal area greyish orange (pl. 5, B3) irrorate with brown in male, with brownish grey (pl. 6, C2) in female. Underside of non-hyaline terminal area very weakly greyish orange in male, greyish brown in female. Male hind tibia simple.

♂ genitalia (Text-figs 9, 10). Uncus tapered, apex curved ventrad; dorsal surface setose and keel-like basad, but without projection. Ventral plate of gnathus strongly sclerotized and scoop-like with rounded tip. Valve shaped similarly to that of *keriaia*, but apical margin unspined and basal, tapered process smaller and transversely, not longitudinally, inclined. Aedeagus differs from that of *keriaia* in presence of a spine-like process at three-fourths dorsal surface. Ornamentation of vesica similar to that of *keriaia*, but the more slender cornutus only one-third as long as aedeagus.

♀ genitalia (Pl. 1, figs 453, 454). Sterigma asymmetrical; lamella antevaginalis extended ventrally enfolding ostium bursae; a hook-shaped, cylindrical extension dorsally. Ductus bursae and corpus bursae merged to form a pyriform sac, weakly ribbed posteriorly.

Measurements. Fore wing: ♂ 10.0–10.5 mm; ♀ 11.5 mm. Antennal pectinations: ♂ 15 ×, ♀ 4 × diameter of shaft.

Similar in size and habitus to *Z. ordinaria* Bethune-Baker in the *pulverosa*-group, but distinguished externally by the clearer, greener-tinged hyaline areas of the wings and by the presence of a minute, discal spot on the fore wing and the absence of a discal spot from the hind wing; in *ordinaria* the discal spot on the fore wing is usually in the form of a small, dark-margined ring and the discal spot on the hind wing is always present. Males may further be distinguished by the appreciably longer epiphysis on the fore tibia; the ratio of epiphysis to fore tibia in *ekphysis* is 6.5:8, the ratio in *ordinaria* is 5:8. In the genitalia the form of the valve and ornamentation of the vesica in the male and the form of the sterigma in the female are diagnostic.

DISTRIBUTION. Kenya.

Holotype ♂, KENYA ('Brit. E. Afr.'): Kiboko R., 5.xi.1896 (*Dr Ansorge*), Geometridae genitalia slide no. 7965, in BMNH.

Paratypes. KENYA: Kibwezi, 12.iii.1917 (*W. Feather*), 1 ♂ without abdomen, 1 ♀.

### *Zamarada inermis* sp. n.

(Text-figs 11, 12; Pl. 2, figs 457, 458; Pl. 95, fig. 840)

♂ ♀ (Pl. 95, fig. 840). Hyaline area of wings tinged with glaucous green, very sparsely irrorate with grey, tinged with vinaceous, and with brown, the latter forming a broken medial fascia; terminal margin of hyaline area very slenderly light yellow, then dark brown; discal spots dark brown, minute; costa of fore wing light yellow and orange-grey irrorate with dark brown. Non-hyaline terminal area orange-grey (pl. 5, B2); dentate and broken subterminal fascia dark brown and cinnamon-brown, weakly marked in female with cinnamon-brown predominating, strongly marked in male with dark brown predominating, especially in discal area of each wing and tornal area of fore wing. Underside of non-hyaline terminal area of each wing pale orange-grey. Male hind tibia simple.

♂ genitalia (Text-figs 11, 12). Uncus very short and tapered with a pair of lateral, shoulder-like projections; dorsal surface setose. Ventral plate of gnathus broad and shallow, minutely scobinate medially. Dorsal process of valve straight, apex broadly rounded; rest of valve simple, parallel-sided, twice as broad as dorsal process; apex of dorsal margin very weakly sclerotized and shortly produced; ventral margin minutely scobinate. Fulcrum slender and straight, of even width to rounded apex and just subequal in length to aedeagus. Vesica with one slender, acicular cornutus, two-thirds as long as aedeagus.

♀ genitalia (Pl. 2, figs 457, 458). Dorsal margin of lamella antevaginalis shallowly excavate medially, the whole enfolding the ostium bursae. Lamella postvaginalis produced posteriorly as a boldly rounded lobe. Ductus bursae sclerotized and ribbed, twice as long as ovate corpus bursae.

Measurements. Fore wing: ♂ 9.5–10.0 mm; ♀ 10 mm. Antennal pectinations: ♂ 15 ×, ♀ 3 × diameter of shaft.

Externally closely similar to *Z. delta* sp. n. in the *pulverosa*-group; distinguished by the minute, solid discal dots, those of species in the *pulverosa*-group being usually small, dark-margined rings. In the genitalia the form of the uncus and valve and the ornamentation of the vesica in the male and the form of the sterigma and ductus bursae in the female are diagnostic.

DISTRIBUTION. Mozambique, Zululand, Cape Province.

Holotype ♂, MOZAMBIQUE ('Port. E. Africa'): E. of Mt Chipirone, 2200 ft, 20.xi.1913 (S. A. Neave), Geometridae genitalia slide no. 6844 in BMNH.

Paratypes. MOZAMBIQUE: Chiluvo Hills, x. 1963, 1 ♀; ibidem, 2.xi.1963, 1 ♀ (both NMR, Bulawayo). ZULULAND: north, Gollel, xi-xii. 1945 (H. W. Bell-Marley), 1 ♀ (TM, Pretoria). CAPE PROVINCE: East London, ix. 1947 (G. C. Clark), 1 ♀ (TM, Pretoria).

### THE *ANSORGEI*-GROUP

In fore wing, venation distinct in the proximity of vein  $M_2$  to  $M_1$ , the upper and lower discocellulars usually being in the ratio of 1 : 2. In the male genitalia the dorsal process of the valve is simple and without a setose projection in the basal fourth and the dorsal margin is extended in digitate form; the fulcrum is reduced and subequal in length to the aedeagus. In the female genitalia the ductus bursae is well developed, equal in length to the corpus bursae. The group includes only one species.

### *Zamarada ansorgei* Warren

(Text-figs 13, 14; Pl. 2, figs 459, 460; Pl. 95, fig. 841)

*Zamarada ansorgei* Warren, 1897 : 261. LECTOTYPE ♂, KENYA (BMNH), here designated [examined].

*Zamarada ansorgei* Warren; Le Cerf, 1922 : 442.

*Zamarada ansorgei* Warren; Prout, 1932 : 507.

♂ ♀ (Pl. 95, fig. 841). Hyaline proximal two-thirds of each wing tinged with buff irrorate with light brown, densely on costa of fore wing and on posterior margin of each wing, and finely edged distally with greyish brown. Terminal non-hyaline area light yellow (pl. 4, A4) irrorate with brownish orange (pl. 5, C5), often forming a dense band bordering hyaline area; subterminal fascia light yellow edged with grey, weakly defined; termen slenderly grey, often broken and represented as interneural spots. Underside marked similarly to upperside. Male hind tibia dilate, enclosing dense tuft of long hair scales.

♂ genitalia (Text-figs 13, 14). Uncus tapered from bulbous base; dorsal surface setose. Ventral plate of gnathus weakly developed. Dorsal process of valve slightly dilate before tapering apicad; apex of valve concave, dorsal margin produced in digitate form. Apical fourth of aedeagus with short, thorn-like projection; fulcrum subequal in length to aedeagus, bilobate at apex. Vesica with small area of dense, short scobination.

♀ genitalia (Pl. 2, figs 459, 460). Sterigma with a pair of short, blade-like processes, one at each side of ostial opening. Ductus bursae sclerotized posteriorly, equal in length to corpus bursae.

Measurements. Fore wing: ♂ 9.0-10.5 mm; ♀ 9-11 mm. Antennal pectinations: ♂ 16 ×, ♀ 6 × diameter of shaft.

In colour and pattern reminiscent of *ordinaria* Bethune-Baker, *psammites* Fletcher and *ochrata* Warren in the *pulverosa*-group; distinguished by the clearly defined, darkly irrorate band immediately distad of the hyaline area, the absence of dark grey or black markings in the non-hyaline terminal area and the denser light brown irroration of the hyaline area; distinguished further in the venation by the more anteriorly placed vein  $M_2$  on the fore wing, the upper and lower discocellulars being usually



in the ratio of 1 : 2. In the male genitalia the form of the valve, which can usually be seen in the dry state, and in the female the form of the sterigma and the slender ductus bursae are diagnostic.

DISTRIBUTION. Kenya, Tanzania.

#### MATERIAL EXAMINED.

*Zamarada ansorgei* Warren, lectotype ♂ here designated, KENYA ('Brit. E. Africa'): Kiboko R., 5.xi.1896 (*Dr Ansorge*), Geometridae genitalia slide no. 5904 in BMNH.

KENYA: lectotype data, 9 ♂ (BMNH) (paralectotypes of *Zamarada ansorgei* Warren); Makindi, i. 1960 (*R. Carcasson*), 1 ♀ (NMK, Nairobi); Kibwezi, xi-iii (*W. Feather*), 13 ♂, 15 ♀; ibidem, 3000 ft, ii-iii. 1892 (*F. J. Jackson*), 1 ♀; ibidem, xii. 1922 (*Dummer*), 4 ♂, 5 ♀; ibidem, v. 1960 (*R. H. Carcasson*), 1 ♀ (NMK, Nairobi); Kedai [3°17' S. 38°22' E.], 29.xii.1912, 1 ♀. TANZANIA: Taveta, 26.xii.1905 (*K. St A. Rogers*), 1 ♀.

#### THE MINIMARIA-GROUP

The included species are small with a fore wing length of 8-16 mm. The distal areas of the wings are usually densely irrorate with grey and black; the discal spot on the fore wing is usually in the form of a small, dark-margined ring. The *minimaria*-group is characterized in the male genitalia by the presence of a short uncus bearing long setae dorsally and of a well developed ventral plate on the gnathus; the valve is simple and membranous, the dorsal process slender, without setose dilation or projection near base, usually bearing a spine-like or slender projection at three-fourths to four-fifths of its length; in *anacantha* sp. n., *phaeozona* Hampson, *aureo-marginata* Pagenstecher and *griveaudi* sp. n., the dorsal process is simple; the aedeagus in its apical half is usually sclerotized at one side, often either serrate or bearing a single, thorn-like projection; the cornuti on the vesica consist of a cluster of short spines. The male hind tibia is simple, without hair pencil.

In the female genitalia the sterigma is not elaborately developed; in *minimaria* Swinhoe, *latilimbata* Rebel, *townsendi* sp. n. and *anacantha* sp. n. the signum is semi-circular in shape; in *aureomarginata* Pagenstecher and *griveaudi* sp. n. the signum is wanting, in other species it is stellate.

#### KEY TO SPECIES AND SUBSPECIES

- |       |                                                                                                                                                                                                                           |                          |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 1     | Dorsal process of valve with projection at about three-fourths of its length, either triangular, spatulate, tapered or acicular, the projection inclined towards the uncus . . . . .                                      | 2                        |
| -     | Dorsal process of valve straight, curved or angled, but without projection . . . . .                                                                                                                                      | 11                       |
| 2 (1) | Dorsal process of valve with smooth-edged triangular projection at three-fourths. Ventral plate of gnathus trapezoid, apical margin shallowly incised. Apex of fulcrum dilate, apical margin coarsely scobinate . . . . . |                          |
|       |                                                                                                                                                                                                                           | <i>consecuta</i> (p. 38) |
| -     | Dorsal process of valve and gnathus not so formed . . . . .                                                                                                                                                               | 3                        |

- 3 (2) Dorsal process of valve tapered apicad and tipped with a minute, claw-like spine; a very slender, acicular projection at about three-fourths. Fulcrum not extending to tip of aedeagus . . . . . 7
- Dorsal process of valve rounded apicad, without minute spine at tip; projection at about three-fourths not finely acicular. Fulcrum extending beyond tip of aedeagus . . . . . 4
- 4 (3) Projection from three-fourths dorsal process twice as long as apical fourth of valve. Dilate apex of fulcrum coarsely spined . . . . . 5
- Dorsal process of valve slightly constricted at four-fifths with short projection beyond, equal in length to slightly dilate apical fifth. Fulcrum slender, apex finely scobinate . . . . . 6
- 5 (4) Projection from about three-fourths dorsal process of valve spatulate, not tapered. Uncus strongly sclerotized and tapered, apical half one-fourth as wide as basal half; dorsal and ventral surfaces compressed to form chisel-like tip. Aedeagus with thorn-like lateral projection just below apex *mesotaenia* (p. 37)
- Projection from about three-fourths dorsal process of valve tapered. Rounded tip of evenly tapered uncus about one-third as wide as base. Apex of aedeagus smoothly tapered, without projection . . . . . *labrys* (p. 36)
- 6 (4) Dorsal processes on valves symmetrical . . . . . *deceptrix* (p. 38)
- Dorsal processes on valves asymmetrical, basal half of process on left valve twice as broad as basal half of process on right valve . . . . . *delosis* (p. 40)
- 7 (3) Apex of fulcrum slender and minutely, but densely scobinate . . . . . 8
- Apex of fulcrum not scobinate, but weakly sclerotized and dilate to partially enfold ventral surface of aedeagus . . . . . 10
- 8 (7) Apical third of uncus as slender as apical fourth of dorsal process on valve. Several short, thorn-like spines present at seven-ninths aedeagus . . . . . *latilimbata* (p. 30)
- Apical half of uncus stout, twice as broad as apical fourth of dorsal process of valve, tip slightly dilate. Dorsal surface of aedeagus serrate in apical third . . . . . 9
- 9 (8) Vestiture and non-hyaline areas of wings predominantly pale grey mixed with dark grey . . . . . *minimaria minimaria* (p. 28)
- Vestiture and non-hyaline areas of wings predominantly buff mixed with yellowish brown . . . . . *minimaria arenosa* (p. 29)
- 10 (7) Acicular projection from five-sevenths dorsal process of valve one-third as long as apical two-sevenths of valve. Ventral plate of gnathus diamond-shaped, about one-half as broad as base of uncus. Left side of aedeagus coarsely serrate in apical third . . . . . *townsendi* (p. 31)
- Acicular projection from two-thirds dorsal process of valve two-thirds as long as apical third of valve. Apical margin of ventral plate of gnathus broadly rounded, the plate as broad as base of uncus. Aedeagus wholly smooth . . . . . *eurygnathus* (p. 32)
- 11 (1) Membranous valve with well-developed longitudinal, setose ridge parallel with dorsal margin. Apex of fulcrum curved through 180 degrees, tip coarsely scobinate. Madagascar only . . . . . 12
- Membranous valve with a setose longitudinal ridge very rarely developed. Fulcrum straight. Species not occurring in Madagascar . . . . . 13
- 12 (11) Apex of uncus slenderly produced and curved ventrad. Dorsal margin of valve one-half as long as aedeagus. Strongly sclerotized, scobinate tip of fulcrum not extending to tip of aedeagus . . . . . *griveaudi* (p. 34)
- Uncus tapered to rounded apex. Dorsal margin of valve one-third as long as aedeagus. Strongly sclerotized tip of fulcrum extending beyond tip of aedeagus. . . . . *aureomarginata* (p. 33)

- 13 (11) Membranous valve without setose ridge; dorsal process of valve sharply angled at two-thirds. Uncus slenderly produced. Fulcrum with a pair of strongly sclerotized, scobinate projections at two-thirds *anacantha* (p. 32)
- Membranous valve with weak setose, longitudinal ridge parallel with dorsal margin developed in a few examples, but usually absent; dorsal process evenly curved. Uncus short, tapered to narrowly rounded apex. Fulcrum slender and without projection; apical third finely and densely scobinate *phaeozona* (p. 35)

### *Zamarada minimaria* Swinhoe

(Text-figs 15, 16; Pl. 3, figs 461, 462; Pl. 95, figs 843–846; Map 1)

*Zamarada minimaria* Swinhoe, 1895 : 293.

♂ ♀ (Pl. 95, figs 843–846). Proximal two-thirds of wings hyaline, sparsely irrorate with dominant colour of non-hyaline terminal third; medial fascia usually conspicuously light yellow mixed with yellowish brown; discal spot on fore wing pale, ringed with dark brown, that on hind wing a minute, dark dot.

♂ genitalia (Text-figs 15, 16). Uncus short and stout, apex slightly dilate and rounded, base with long setae dorsally. Gnathus broadly curved, medially scobinate. Valve simple, apex rounded; dorsal process with acicular projection at three-fourths. Fulcrum seven-ninths as long as aedeagus, apex minutely but densely scobinate. Aedeagus tapered and sclerotized in apical third, dorsal surface partly serrate. Vesica with a cluster of 9–10 spines.

♀ genitalia (Pl. 3, figs 461, 462). Ostium bursae slightly asymmetrical, incised medially on posterior margin. Corpus bursae membranous; signum semi-circular, edges serrate.

Measurements. Fore wing: ♂ 8–11 mm; ♀ 7.50–11.25 mm. Antennal pectinations: ♂ 11 ×, ♀ 8 × diameter of shaft.

Distinguished from the superficially rather similar *Z. torrida* sp. n. by the clearly ringed, not elongate, discal spot on the fore wing and by the presence of the yellowish medial fascia on each wing. In the male, *minimaria* may be further distinguished by the simple hind tibia; that of *torrida* is dilate, enclosing a tuft of long hair-scales.

DISTRIBUTION (Map 1). Pakistan, Iran, Saudi Arabia, Yemen, Sudan, Chad, Niger, S. Algeria.

Two subspecies are recognized, distinguished by the colour of the vestiture and wings.

### *Zamarada minimaria minimaria* Swinhoe

(Pl. 95, figs 843, 844, Map 1)

*Zamarada minimaria* Swinhoe, 1895 : 293. Holotype ♀, PAKISTAN (BMNH) [examined].

*Zamarada minimaria* Swinhoe; Hampson, 1896 : 552.

*Zamarada minimaria iranica* Brandt, 1941 : 878, pl. 30, fig. 36. Holotype, sex unknown, IRAN (believed to be in Naturhistoriska Riksmuseet, Stockholm, but not yet found).

*Zamarada minimaria iranica* Brandt; Wiltshire, 1949 : 425, text-fig. 109 (♂ genitalia).

♂ ♀. Vestiture and basal area of each wing pale grey mixed with dark grey. Non-hyaline terminal third of each wing dark grey mixed with silvery grey and black.

DISTRIBUTION (Map 1). Pakistan, Iran, Saudi Arabia, Yemen.

## MATERIAL EXAMINED.

*Zamarada minimaria* Swinhoe, holotype ♀, PAKISTAN: Karachi, vi. 1885 '*Zamarada minimaria* Swinhoe ♂ [sic] type', Geometridae genitalia slide no. 1596, in BMNH.

The specimen of *Zamarada minimaria iranica* Brandt, labelled as type by its author, is believed to be in the Naturhistoriska Riksmuseet in Stockholm, but it has not yet been found (Gustavsson *in litt.*, 11.viii.1971). The taxon is, however, represented by several topotypical paratypes listed below.

PAKISTAN: Karachi, iii. 1918 (*Capt. C. B. Ticehurst*), 1 ♀. IRAN: Baluchestan, Bender Tchahbahar, xii. 1937–iii. 1938 (*Brandt*), 2 ♂, 3 ♀ (paratypes of *Zamarada minimaria iranica* Brandt) (BMNH); Strasse-Tchahbahar-Iranchar, Tahte-Malek, 750 m, Anfang iv. 1938 (*Brandt*), 2 ♂, 1 ♀ (paratypes of *Zamarada minimaria iranica* Brandt) (ZSBS, Munich); Baluchestan, Iranshar, 800 m, 28–31.iii.1934 (*Richter u. Schäuffele*), 4 ♂, 2 ♀ (ZSBS, Munich). SAUDI ARABIA: Buraiman, 19.i.1948 (*E. P. Wiltshire*), 2 ♀ (BMNH); El Riad, 6.vii.1959 (*E. Dierl*), 1 ♀ (ZSBS, Munich); Jidda, ii, iv, v, 5 ♂, 8 ♀; Mecca, i, iv, 2 ♀; Taif, 23.vi.1934, 1 ♀; Wadi Qarma [19°32' N. 40°58' E.], 14.ii.1937, 1 ♀; Aina [Ayna, 17°50' N. 43°16' E.], 5.xii.1936, 1 ♀; Najran, 1–3.xi.1936, 1 ♀ (all *H. St. J. Philby*). YEMEN: Wadi Auban [16°32' N. 45°06' E.], 7.x.1936 (*H. St. J. Philby*), 1 ♀; Hodeida, 20.ix.1962 (*G. Popov*), 1 ♀; Near Saada [14°14' N. 46°25' E.], 27.vii.1962 (*G. Popov*), 2 ♀ (all BMNH).

***Zamarada minimaria arenosa* subsp. n.**

(Pl. 95, figs 845, 846; Map 1)

♂ ♀. Distinguished from the nominate subspecies by the yellowish brown colour of the vestiture and wings. Vestiture and basal area of each wing yellowish white mixed with brownish yellow and pale grey. Non-hyaline terminal third of each wing yellowish white, irrorate lightly with silvery grey and very lightly with black; subterminal fascia brownish yellow, broad and irregular.

DISTRIBUTION (Map 1). Sudan, Niger, S. Algeria.

Holotype ♂, SUDAN: Ed Damer, Hudeiba [17°37' N. 33°59' E.], 13.ii.1962 (*R. Remane*) in ZSBS, Munich.

Paratypes. SUDAN: Kerma, 25.ii.1904, 1 ♀; Nakheila, R. Atbara, 5–8.ii.1904, 1 ♂, 2 ♀ (BMNH); Ed Damer, Hudeiba, i. 1962 (*R. Remane*), 13 ♂, 14 ♀; ibidem, ii. 1962, 43 ♂, 23 ♀; ibidem, iii. 1962, 43 ♂, 47 ♀; ibidem, iv. 1962, 7 ♂, 1 ♀; ibidem, v. 1962, 6 ♂, 1 ♀; ibidem, vi. 1962, 2 ♀; ibidem, 25.vii.1962, 1 ♂, 1 ♀; ibidem, 8.viii.1962, 1 ♂; ibidem, xi. 1961, 2 ♂, 2 ♀; ibidem, xii. 1961, 5 ♂, 3 ♀ (ZSBS, Munich); Shendi (*N. C. Rothschild*), 2 ♂, 2 ♀ (BMNH); Blue Nile Province, Wad Medani, 2.viii.1962 (*R. Remane*), 1 ♀ (ZSBS, Munich).

The following examples are associated with subspecies *arenosa*, but are excluded from the type-series, being somewhat intermediate in wing colouring between subsp. *arenosa* and the nominate subspecies.

NIGER: Aïr, Tagengir R., 13.x.1922 (*A. Buchanan*), 1 ♂. ALGERIA: south, [Ahaggar] Oued Amra, no. of Ideles [23°50' N. 5°55' E.], 4.iv.1914, 1 ♀; Ti-n-tabarik



ca 25°60' n.lat., 14.iv.1914, 1 ♀; Timenaiin, ca. 25°75' n.lat., 3.iii.1914, 1 ♂; Rharris [25°50' N. 5°0' E.], 15.iv.1914, 3 ♂, 2 ♀; Amgid, ca. 26°30' n.lat., 13.ii.1914, 1 ♂, all (G. von Schweppenh.) (BMNH). CHAD: [S.E. Tibesti], Guelte Zouré [20°20' N. 16°03' E.], 24.xi.1957, 1 ♂, 1 ♀ (MNHN, Paris).

### *Zamarada latilimbata* Rebel

(Text-figs 17, 18; Pl. 3, figs 463, 464; Pl. 95, fig. 842)

*Zamarada latilimbata* Rebel, 1948 : 59. LECTOTYPE ♀, EGYPT (NM, Vienna), here designated [examined].

*Zamarada latilimbata* Rebel; Wiltshire, 1949 : 425, text-fig. 110 (♂ genitalia), pl. 9, figs 19, 20.

♂ ♀ (Pl. 95, fig. 842). Hyaline area of wings evenly irrorate with grey and finely edged distally with dark grey; medial fascia dark grey, ill-defined and sometimes wanting; basal area and non-hyaline terminal area of each wing grey lightly irrorate with buff; dentate subterminal fascia a darker shade of grey; cilia chequered buff and grey.

♂ genitalia (Text-figs 17, 18). Apical half of uncus evenly slender, tip rounded; base of uncus with long setae dorsally. Ventral plate of gnathus bilobate and scobinate. Valve similar to that of *minimaria*, but acicular projection from dorsal process longer. Fulcrum eight-ninths as long as aedeagus, apical fifth slender and scobinate; aedeagus sclerotized in apical third and tapered with one large and three or four small, tooth-like projections at one side. Vesica with a cluster of four arcuate spines.

♀ genitalia (Pl. 3, figs 463, 464). Ostium bursae symmetrical, doubly bilobate posteriorly. Posterior fourth of corpus bursae sclerotized; signum almost semi-circular, edges serrate; ductus seminalis dilate forming globular sac.

Measurements. Fore wing: specimens from Saudi Arabia, Yemen and Egypt, ♂ 10–11 mm; ♀ 10–12 mm. Specimens from Kenya, ♂♀ 8–9 mm. Antennal pectinations: ♂ 16 ×, ♀ 4 × diameter of shaft.

Differs from *minimaria* in its larger size, in the absence of a light yellow medial fascia on each wing and in the antennal pectinations, which are longer in the male and shorter in the female. In the male genitalia *latilimbata* differs in the slender uncus, in the bilobate ventral plate of the gnathus and in the longer acicular projection from the dorsal process of the valve; further, in the form of the aedeagus and the fewer arcuate cornuti on the vesica. In the female genitalia of *latilimbata* the form of the ostium bursae and of the corpus bursae are diagnostic.

DISTRIBUTION. Saudi Arabia, Yemen, Egypt, Kenya.

#### MATERIAL EXAMINED.

The two female syntypes on which Rebel based his description of the species are in the Naturhistorisches Museum in Vienna. They bear the following pin-data.

Printed labels. EGYPT Min. Agric. (Egypt) Coll. Prof. Priesner. GABAL ELBA W. AIDEB 31.i.1933 [published as 1931] L. TRAP.

Hand-written by Rebel. *Zamarada latilimbata* Rbl. Type ♀.

The specimen from which the genitalia preparation has been made is here designated lectotype. The second specimen has been labelled paralectotype.

SAUDI ARABIA: [Upper Habauna and Najran Dist.], Mahidh, 21.xi.1936, 3 ♂,

4 ♀; Wadi al Husn, 22.xi.1936, 1 ♀; Wadi Hanaka, 23-24.xi.1936, 2 ♂, 2 ♀; Faqwa [near Jizan], 26.xii.1936, 1 ♂; [Taif Plateau] Ukadh, 13.i.1935, 1 ♀, all (*H. St. J. Philby*) (BMNH). YEMEN: Dhala, 4800 ft, ix. 1942 (*P. W. R. Petrie*), 1 ♂; Jebel Jihaf, ca 7100 ft, x. 1937 (*H. Scott & E. B. Britton*), 1 ♂; Nr Saada, 27.vii.1962 (*G. Popov*), 1 ♂, 1 ♀ (BMNH). EGYPT: Wadi Aideb, 31.i.1931, 1 ♀ (Dept. of Agric. coll., Cairo). KENYA: Turkana nord, Lokitaung, 750 m, 1932-33, 1 ♂ (MNHN, Paris); N.F.D., Isiolo, Archers Post, xii. 1963 (*R. H. Carcasson*), 1 ♂, 3 ♀ (NMK, Nairobi); Nairobi, Langata, vi. 1961 (*D. Minter*), 1 ♀ (BMNH).

### *Zamarada townsendi* sp. n.

(Text-figs 19, 20; Pl. 4, figs 465, 466; Pl. 96, figs 849-851)

[*Zamarada phaeozona* Hampson sensu Fletcher, 1958 : 141. Misidentification.]

♂ ♀ (Pl. 96, figs 849-851). Hyaline area of wings varyingly, but usually lightly, irrorate with brownish yellow, the irroration often concentrated medially to form an ill-defined medial fascia. Basal area of each wing, edged distally with a dark antemedial fascia, and non-hyaline terminal third, edged proximally with a fine, black postmedial fascia, brownish orange (pl. 5, C6, Pompeian yellow) to yellowish brown (pl. 5, D5, clay); subterminal fascia glossy buff, edged proximally with black, usually marked in costal, discal and tornal areas of fore wing, but often wanting. In a few examples the area between the postmedial and subterminal fasciae is uniformly black.

♂ genitalia (Text-figs 19, 20). Uncus tapered to narrowly rounded tip; base with long setae dorsally. Ventral plate of gnathus diamond-shaped, minutely scobinate. Valve simple, apex slightly tapered; dorsal process with acicular projection at five-sevenths. Fulcrum eight-ninths as long as aedeagus, apex broad and spatulate; aedeagus slenderly sclerotized and serrate at one side in apical half. Vesica with a cluster of 12-15 spines.

♀ genitalia (Pl. 4, figs 465, 466). Ostium bursae asymmetrical, posterior margin incised medially. Ductus seminalis broadly spiral. Corpus bursae sclerotized and ribbed posteriorly; signum almost semi-circular, the edges only minutely and sparsely serrate.

Measurements. Fore wing: ♂ 10.0-13.5 mm; ♀ 9-13 mm. Antennal pectinations: ♂ 14 ×, ♀ 3 × diameter of shaft.

Most examples are distinguishable externally from *minimaria* and from *latilimbata* by the brownish yellow to yellowish brown colour of the non-hyaline terminal third of each wing. In the male genitalia the form of the ventral plate of the gnathus and of the aedeagus and in the female the form of the ostium bursae, the ductus seminalis and the sclerotization of the corpus bursae are diagnostic.

The species is named in honour of the late A. L. H. Townsend of Nakuru, who successfully reared this and very many other species of Kenyan Lepidoptera.

DISTRIBUTION. Kenya, Uganda.

Holotype ♂, KENYA: Nakuru, bred, 19.i.1949 (*A. Townsend*), Geometridae genitalia slide no. 6571 in BMNH.

Paratypes. KENYA: Nakuru, 18.iv.1942 (*A. Townsend*), 1 ♂ (BMNH); ibidem, bred, 26.iv.1943, 1 ♂ (TM, Pretoria); ibidem, 23-24.vi.1943, 2 ♀ (NMK, Nairobi); ibidem, 24.vi.1943, 1 ♀ (BMNH); ibidem, 11.xi.1944, 1 ♀ (BMNH); ibidem, 27-29.xi.1944, 1 ♂, 1 ♀ (NMK, Nairobi); ibidem, 17.ii.1946, 1 ♀ (BMNH); ibidem,

16.x.1947, 1 ♂ (NMK, Nairobi); ibidem, 1.ii.1948, 1 ♂; 17.iv.1948, 1 ♂; 24.v.1948, 1 ♂; 6.ix.1948, 1 ♂; 12.ix.1948, 1 ♀; 18.x.1949, 1 ♀; 22.xi.1951, 1 ♀ (BMNH); ibidem, 2-4.vii.1953, 2 ♂ (NMK, Nairobi), 1 ♂, 1 ♀ (BMNH); ibidem, 5.viii.1954, 1 ♂ (BMNH); Kericho, 1965 (*R. Coulson*), 1 ♀; Mt Elgon, iv. 1958 (*T. H. E. Jackson*), 1 ♀; ibidem, viii. 1958, 1 ♂ (all BMNH); Elgon Saw Mill, Mt Elgon, 2470 m, Mission de l'Omo, 1932-33 (*C. Arambourg, P. A. Chappuis et R. Jeannel*), 1 ♀ (MNHN, Paris). UGANDA: Jinja, Mabira Forest, x. 1962, 1 ♀; Masaka, Katera, Sango Bay, 1 ♀; Toro, Kibale Forest, v. 1966, 1 ♀ (BMNH), 1 ♀ (NMK, Nairobi); Fort Portal, Mpanga Forest, ii. 1957, 1 ♀, all (*R. H. Carcasson*); Budongo Forest, 7.ii.1935 (*F. W. Edwards*), 1 ♀; Ibanda, 4700 ft, 20-21.viii.1952 (*D. S. Fletcher*), 1 ♀.

### *Zamarada eurygnathus* sp. n.

(Text-figs 21, 22; Pl. 96, fig. 852)

♂ (Pl. 96, fig. 852). Hyaline area of each wing lightly irrorate with brownish orange and black, mainly in medial area to form an ill-defined medial fascia. Non-hyaline terminal third of each wing brownish orange (pl. 5, C5, topaz), irrorate and patterned with black as illustrated; basal area of each wing black.

♂ genitalia (Text-figs 21, 22). Uncus with rounded tip, base with long setae dorsally. Ventral plate of gnathus broad, apical margin curved. Valve simple, apex slightly tapered; dorsal process with acicular projection at two-thirds. Fulcrum about four-fifths as long as aedeagus, apex spatulate; apical half of aedeagus slenderly and smoothly sclerotized at one side. Vesica with a dense cluster of spines.

♀ unknown.

Measurements. Fore wing: ♂ 12.5 mm. Antennal pectinations: ♂ 13 × diameter of shaft.

Differs from the closely related *townsendi* in the form of the ventral plate of the gnathus, the longer, acicular projection from the dorsal process of the valve and the smoothly edged, sclerotized apical half of the aedeagus.

DISTRIBUTION. Kenya.

Holotype ♂, KENYA: Nairobi, Ngong, vii. 1954 (*Fowler & Coulson*), Geometridae genitalia slide no. 6563 in BMNH.

### *Zamarada anacantha* sp. n.

(Text-figs 23, 24; Pl. 4, figs 467, 468; Pl. 95, fig. 847)

♂ ♀ (Pl. 95, fig. 847). Hyaline area of each wing irrorate with brownish orange and grey and finely edged distally with black; antemedial and medial fasciae dark grey, the former usually sharply marked, the latter ill-defined and often wanting. Non-hyaline terminal third of each wing brownish orange (pl. 5, C6, Pompeian yellow) proximad of dentate sub-terminal fascia, elsewhere densely irrorate with dark and silvery grey and lightly irrorate with black.

♂ genitalia (Text-figs 23, 24). Apical third of uncus produced to blunt tip; base with long setae dorsally. Ventral plate of gnathus broad, rounded and scobinate. Valve simple with narrowly rounded apex; dorsal process sharply angled at two-thirds, without projection. Fulcrum subequal in length to aedeagus; a pair of strongly sclerotized, scobinate projections at two-thirds; aedeagus sclerotized in apical half and serrate at one side. Vesica with a dense cluster of spines.

♀ genitalia (Pl. 4, figs 467, 468). Posterior margin of ostium bursae shallowly bilobate. Ductus seminalis dilate. Posterior half of corpus bursae sclerotized and ribbed; signum almost semicircular in shape, the edges minutely serrate. Seventh sternum strongly sclerotized.

Measurements. Fore wing; ♂ 9-10 mm, ♀ 9-11 mm. Antennal pectinations: ♂ 12 ×, ♀ 3 × diameter of shaft.

Externally closely similar to the nominate subspecies of *minimaria* Swinhoe, with which it occurs in Yemen. The short, blunt uncus, the form of the ventral plate of the gnathus, the angled dorsal process of the valve and the form of the fulcrum in the male genitalia and the form of the ostium bursae and the strongly sclerotized seventh sternum in the female are diagnostic.

DISTRIBUTION. Saudi Arabia, Yemen, Egypt, Sudan, Senegal, Ghana, Nigeria.

Holotype ♂, SUDAN: Ed Damer, Hudeiba, 9.viii.1962 (*R. Remane*), in ZSBS, Munich.

Paratypes. YEMEN: Hodeida, 20.ix.1962 (*G. Popov*), 1 ♂. SAUDI ARABIA: Abs Tihama, 29.ix.1962 (*G. Popov*), 1 ♀. EGYPT: Nakheila, R. Atbara, 4.ii.1904, 1 ♀. SUDAN: Fung Prov., Singa, 18.xi.1927 (*A. W. M. Disney*), 1 ♀ (all BMNH); Ed Damer, Hudeiba, 21.i.1962 (*R. Remane*), 1 ♂; ibidem, 25. i, 1 ♀; 14. ii, 1 ♀; 26. vii, 1 ♀; 8. viii, 1 ♂, 2 ♀; 9. viii, 1 ♀; 12. viii, 1 ♂; 16. viii, 1 ♀; 8. x, 2 ♂, 1 ♀; 9. x, 1 ♂, 4 ♀; Blue Nile Prov., Wad Medani, 2.viii.1962 (*R. Remane*), 2 ♂ (all ZSBS, Munich); Khartoum, 15.x.1924 (*H. B. Johnston*), 1 ♀; ibidem, 9.iv.1970 (*J. Mallet*), 1 ♂ (both BMNH); Darfur, Djebel Marrah, 1 ♂ (coll. Herbulot, Paris). SENEGAL: Sedhiou, 1917 (*H. Castell*), 1 ♀; Kaolack, 1909 (*G. Melou*), 1 ♀, both BMNH. GHANA (Gold Coast): N. Territories, Kete-Krachi (*A. W. Cardinall*), 1 ♀ (BMNH). NIGERIA: Gadau [11°50' N. 10°05' E.], ii. 1933 (*Buxton & Lewis*), 5 ♂, 6 ♀ (BMNH).

### *Zamarada aureomarginata* Pagenstecher

(Text-figs 25, 26; Pl. 5, figs 469, 470; Pl. 96, figs 853, 854)

*Zamarada aureomarginata* Pagenstecher, 1907 : 95, pl. 6, fig. 6. Holotype ♀, MADAGASCAR (MNHU, Berlin) [examined].

♂ ♀ (Pl. 96, figs 853, 854). Costa and posterior margin of fore wing and non-hyaline terminal third of each wing yellowish grey (pl. 4, B2) varyingly irrorate with black; postmedial and subterminal fasciae slenderly and brokenly black edged distally with silvery grey, area between fasciae partly suffused with brownish orange; discal spot on fore wing silvery grey outlined with black, that on hind wing black and minute. In some male examples the black irroration is dense and extensive.

♂ genitalia (Text-figs 25, 26). Uncus evenly tapered to rounded tip; base with long setae dorsally. Ventral plate of gnathus weakly sclerotized. Valve with longitudinal setose ridge parallel with dorsal margin, which is one-third as long as the aedeagus; dorsal process of even width, curved apicad. Aedeagus tapered; fulcrum longer than aedeagus, tip curved dorsad through 180 degrees and coarsely spined. Vesica with a cluster of short spines.

♀ genitalia (Pl. 5, figs 469, 470). Lamella antevaginalis bilobate posteriorly. Anterior fourth of corpus bursae membranous, remainder ribbed and sclerotized; no signum. Seventh sternum evenly sclerotized.

Measurements. Fore wing: ♂ 8.0-9.5 mm; ♀ 9-10 mm. Antennal pectinations: ♂ 10 ×, ♀ 4 × diameter of shaft.



This and the second Mascarene species in the *minimaria*-group, *Z. griveaudi* sp. n., are distinguished from the externally similar *anacantha*, to which they are probably most closely related, by the presence of the longitudinal, setose ridge on the valve in the male genitalia and by the absence of a signum from the corpus bursae in the female genitalia. In *aureomarginata* the form of the uncus, the length of the dorsal margin of the valve and the form of its dorsal process and the length of the fulcrum in the male genitalia and the form of the sterigma in the female genitalia are diagnostic.

DISTRIBUTION. S. Madagascar.

#### MATERIAL EXAMINED.

*Zamarada aureomarginata* Pagenstecher, holotype ♀ (without abdomen), MADAGASCAR: S.W., Tulear (*Voeltzkow*), in MNHU, Berlin.

MADAGASCAR: S.W., Tulear, 30.vii.1929 (*E. I. White*), 1 ♀; La Table, 29.viii.1929 (*E. I. White*), 1 ♀ (both BMNH); sud, cordon littoral Mahafaly, env. d'Efoetsy, 10 m, 30.xi-3.xii.1967 (*P. Griveaud*), 2 ♂, 2 ♀; lac Tsimananpetsotsa, 4-5.viii.1967 (*P. Griveaud*), 7 ♂, 2 ♀; Ambovombé, 29.i.1932 (*R. Decary*), 1 ♀ (all MNHN, Paris).

#### *Zamarada griveaudi* sp. n.

(Text-figs 27, 28; Pl. 5, figs 471, 472)

♂ genitalia (Text-figs 27, 28). Uncus tapered, apex produced and curved ventrad; base with long setae dorsally. Ventral plate of gnathus sclerotized, tip narrowly rounded. Valve with longitudinal setose ridge parallel with dorsal margin of valve, which is one-half as long as aedeagus; dorsal process slightly dilate and curved at one-half. Aedeagus tapered; sclerotized core of fulcrum shorter than aedeagus, tip curved dorsad through 180 degrees and coarsely spined. Vesica with a cluster of short spines.

♀ genitalia (Pl. 5, figs 471, 472). Lamella antevaginalis crescent-shaped. Anterior third of corpus bursae membranous, remainder ribbed and sclerotized; no signum.

Measurements. Fore wing: ♂ 9-10 mm; ♀ 10.0-10.5 mm. Antennal pectinations: ♂ 12 ×, ♀ 4 × diameter of shaft.

Externally closely similar to *aureomarginata*, with which it occurs. Distinguished in the male genitalia by the narrower uncus, the longer, more slender valve and the form of its dorsal process, dilate at one-half, and the shorter fulcrum; distinguished in the female genitalia by the crescent-shaped lamella antevaginalis. The distinguishing characters of the uncus in the male and of the lamella antevaginalis in the female can be seen without dissection.

DISTRIBUTION. S. Madagascar.

Holotype ♂, MADAGASCAR: sud, lac Tsimananpetsotsa, 4-5.viii.1967 (*P. Griveaud*), in MNHN, Paris.

Paratypes. MADAGASCAR: holotype data, 6 ♂, 3 ♀; sud, cordon littoral Mahafaly, env. d'Efoetsy, 10 m, 30.xi-3.xii.1967 (*P. Griveaud*), 2 ♀; sud, Env. Efoetsy, 8 m, 30.xi-3.xii.1967 (*P. Griveaud*), 2 ♀; sud, Andranomanoetse-Be, aven du Plateau,

Mahafaly, 70 m, 29-31.viii.1967 (*P. Griveaud*), 1 ♂ (all in MNHN, Paris); sud, Amboasary, R. Mandrare, 1934 (*R. Catala*), 1 ♀ (BMNH); sud, Behara, i. 1954 (*R. Paulian*), 1 ♂ (MNHN, Paris); sud, Ambovombe, Amboasary, ii. 1956 (*A.R.*), 1 ♀ (MNHN, Paris); sud, Tulear Prov., Betioky Agricultural Station, 275 m, 27.iii.1968 (*K. M. Guichard*), 1 ♀ (BMNH).

*Zamarada phaeozona* Hampson

(Text-figs 29, 30; Pl. 6, figs 473, 474; Pl. 95, fig. 848)

*Zamarada phaeozona* Hampson, 1909 : 123, pl. 4, fig. 51. Holotype ♂, UGANDA (BMNH) [examined].

♂ ♀ (Pl. 95, fig. 848). Hyaline area of each wing irrorate with brownish yellow, grey and black; antemedial fascia and ill-defined medial fascia, when present, grey. Non-hyaline terminal third of each wing brownish yellow to light brown, densely irrorate with silvery grey and dark grey; postmedial fascia black; broken, dentate subterminal fascia dark grey to black, finely edged distally with a glossy, light buff.

♂ genitalia (Text-figs 29, 30). Uncus short and bluntly tipped; base with long setae dorsally. Ventral plate of gnathus minutely scobinate with a small U-shaped depression medially. Valve simple, apex narrowly rounded; a weak, setose, longitudinal ridge, parallel with dorsal margin, is developed in a few examples; dorsal process simple, slightly dilate and curved at two-thirds. Fulcrum equal in length to aedeagus, apical third finely and densely scobinate, the longest spines at apex; aedeagus narrowly rounded at apex, a band of spines situate at one side from two-thirds to five-sixths of its length. Vesica with a cluster of short spines.

♀ genitalia (Pl. 6, figs 473, 474). Posterior margins of lamellae sometimes irregularly crenulate, as in figure (Pl. 6, fig. 474), sometimes smooth. Corpus bursae sclerotized posteriorly, as figured; signum discoid, the perimeter shortly serrate.

Measurements. Fore wing: 8.5-11.5 mm; ♀ 9-12 mm. Antennal pectinations: ♂ 11 ×, ♀ 2 × diameter of shaft.

Externally closely similar to *anacantha*; distinguished structurally by the form of the gnathus, by the simple, curved dorsal process of the valve, by the form of the fulcrum and of the aedeagus in the male genitalia and by the form of the sterigma and the extent of the sclerotization of the corpus bursae in the female genitalia.

The degree and extent of the spining of the fulcrum shows some variation; in examples from Mozambique, Angola and South West Africa there is a cluster of longer spines at five-eighths of its length that are comparable in size with the apical cluster.

The short series of five males and three females from Dire Daoua in Ethiopia, a male from Kibwezi in Kenya, two males and a female from Amani in Tanzania and a male and female from Quirimbo in Angola differ from the remainder of the material available for study in their smaller size (fore wing 8.5-9.0 mm) and paler colour.

DISTRIBUTION. Ethiopia, Uganda, Kenya, Tanzania, Mozambique, Transvaal, Angola, South West Africa.

## MATERIAL EXAMINED.

*Zamarada phaeozona* Hampson, holotype ♂, UGANDA: S.E. Ruwenzori [Mokia], 3500 ft, 17.vi.1906 (*Hon. G. Legge & A. F. R. Wollaston*), Geometridae genitalia slide no. 1700 in BMNH.

ETHIOPIA: Dire Daoua, ii-v. 1935 (*H. Uhlenhuth*), 5 ♂, 3 ♀; Tumha, 7000 ft, 21.vi.1920 (*R. E. Cheeseman*), 1 ♂. KENYA: N.F.D., Isiolo, Archers Post, xii. 1963 (*R. H. Carcasson*), 1 ♀ (NMK, Nairobi); Hoey's Bridge (*Capt. Pitman*), 1 ♂; Nairobi (*van Someren*), 1 ♂; ibidem, vii. 1927 (*D. M. Hopkins*), 1 ♂; Mt Elgon, i, iii, vii, x-xii (*T. H. E. Jackson*), 6 ♂, 8 ♀ (BMNH); ibidem, xi, 1 ♂ (NMK, Nairobi); S.W. Elgon, 6700 ft, vi-viii. 1961 (*T. H. E. Jackson & J. Abraham*), 2 ♂ (BMNH); Kitale, vii. 1958 (*C. Howard*), 2 ♀ (NMK, Nairobi); Kibwezi, xii. 1920 (*W. Feather*), 1 ♂; Nyali, xii. 1968 (*D. G. Sevastopulo*), 1 ♀ (both BMNH). TANZANIA: Usambara, Amani, xii-i (*G. Pringle*), 2 ♂, 1 ♀ (BMNH). MOZAMBIQUE: Chagalane, xi. 1950 (*Mrs M. Ferreira*), 1 ♂ (TM, Pretoria). TRANSVAAL: Kruger National Park Survey, Punda Milia, 21-23.xi.1961 (*Vári & Rorke*), 1 ♀; Nwanedzi, 30.iv-1.v.1968 (*Potgieter & Goode*), 1 ♀ (both TM, Pretoria). ANGOLA: Quirimbo, 75 km E. of Amboim, 300 m, 7-12.v.1934 (*K. Jordan*), 1 ♂, 1 ♀; Benguela, ix. 1957 (*A. Archer*), 1 ♂ (both BMNH). SOUTH WEST AFRICA: Abachaus [160 miles N. of Windhoek], 12.xii.1938 (*G. Meyer*), 1 ♂ (TM, Pretoria).

*Zamarada labrys* sp. n.

(Text-figs 31, 32; Pl. 6, figs 475, 476; Pl. 96, fig. 855)

[*Zamarada pulverosa* Warren sensu Swinhoe, 1904 : 516 (*nec* Tana R. ♀). Misidentification].  
[*Zamarada phaeozona* Hampson, 1909 : 123, subsp. 1. Misidentification.]

♂ ♀ (Pl. 96, fig. 855). Hyaline area of wings usually densely irrorate with yellowish brown and grey and finely edged distally with black; antemedial fascia on fore wing and medial fascia on each wing dark grey to black, usually ill-defined, sometimes absent. Non-hyaline terminal third of each wing yellowish brown to light brown, varyingly irrorate with dark grey to black; dentate subterminal fascia broken and black, usually most clearly indicated by its fine distal edging of white scales.

♂ genitalia (Text-figs 31, 32). Uncus evenly tapered to rounded apex; base with long setae dorsally. Arms of gnathus broad; ventral plate deep with small tongue-like projection medio-posteriorly. Valve simple, broadly rounded at apex; dorsal process with tapered, sclerotized projection at three-fourths. Fulcrum a little longer than aedeagus, apical third scobinate, the tip bearing two or more stout spines; aedeagus smoothly and finely tapered. Vesica with a cluster of short spines.

♀ genitalia (Pl. 6, figs 475, 476). Ostium bursae smaller than area of signum; posterior margin of lamella postvaginalis curved. Posterior half of corpus bursae sclerotized and narrowed posteriorly; signum ovate and stellate. Seventh sternum sclerotized in distinctive form, as figured.

Measurements. Fore wing: ♂ 12.5-14.5 mm; ♀ 14 mm. Antennal pectinations: ♂ 14 ×, ♀ 3 × diameter of shaft.

Externally rather like a large example of *phaeozona*, for which Hampson understandably mistook it. Structurally the form of the gnathus, of the dorsal process of the valve and of the smoothly tapered aedeagus in the male genitalia and the

sclerotized pattern of the seventh sternum, the very small, simple ostium bursae and the form of the sclerotized posterior half of the corpus bursae in the female genitalia are diagnostic.

DISTRIBUTION. Kenya.

Holotype ♂, KENYA: Machakos, 24.vi.1898 (*R. C. Crawshay*), '*Zamarada phaeozona* subsp. type ♂ Hmpsn.', in BMNH.

Paratypes. KENYA: Machakos, 16.vi.1898 (*R. C. Crawshay*), 1 ♂; ibidem, 14.ix.1898, 1 ♀; ibidem, 11.xii.1898, 1 ♀; Nairobi, iv. 1905 (*Jackson*), 1 ♂; ibidem, i. 1951 (*A. F. J. Gedye*), 1 ♀; Nairobi, Thika Road, vii. 1952 (*E. Pinhey*), 1 ♂ (all BMNH); Kilifi, vi. 1949, 1 ♂ (NMK, Nairobi).

### *Zamarada mesotaenia* Prout stat. n.

(Text-figs 33, 34; Pl. 7, figs 477, 478; Pl. 96, fig. 856)

*Zamarada consecuta mesotaenia* Prout, 1931 : 272. Holotype ♂, SOMALIA (BMNH) [examined].

♀ (Pl. 96, fig. 856). Hyaline area of each wing irrorate with black and finely edged distally with the sharply marked, black postmedial fascia; discal spots large, that on fore wing grey ringed with black, that on hind wing black and ovate; antemedial fascia on fore wing black, medial fascia on each wing usually broad and black, sometimes ill-defined. Non-hyaline terminal third of each wing light brown densely irrorate with black; subterminal fascia dentate, broken and black, edged distally with a few scattered white scales.

♂ genitalia (Text-figs 33, 34). Uncus strongly sclerotized; apical half one-fourth width of basal half and tapered, dorsal and ventral surfaces compressed to form chisel-like tip. Ventral plate of gnathus almost triangular. Valve simple, broadly rounded at apex; dorsal process with a weakly sclerotized, spatulate projection at three-fourths. Fulcrum extending beyond aedeagus, apex broadened and coarsely scobinate; aedeagus tapered apicad, with thorn-like projection at one side near apex. Vesica with a cluster of short spines.

♀ genitalia (Pl. 7, figs 477, 478). Lamella postvaginalis broadly rounded posteriorly. Posterior third of corpus bursae sclerotized and ribbed; signum stellate.

Measurements. Fore wing: ♂ 12–15 mm; ♀ 13.5–15.5 mm. Antennal pectinations: ♂ 12 ×, ♀ 3 × diameter of shaft.

Externally closely similar to, but a little darker than the preceding species, *labrys*. Structurally the form of the uncus, the well developed, almost triangular ventral plate of the gnathus, the form of the dorsal process of the valve and of the aedeagus and fulcrum in the male genitalia and the broadly rounded lamella postvaginalis in the female genitalia are diagnostic.

DISTRIBUTION. Somalia, Kenya.

#### MATERIAL EXAMINED.

*Zamarada consecuta mesotaenia* Prout, holotype ♂, SOMALIA ('Br. Somaliland'): Sugli, Al Hills, 4700 ft, Lat. 10°58' N., Long. 48°53' E., xi. 1929 (*C. L. Collenette*), Geometridae genitalia slide no. 1603, in BMNH.

SOMALIA: holotype data, 1 ♀ (*Zamarada consecuta mesotaenia* Prout allotype) (BMNH). KENYA: Nakuru, bred, 8.iii.1936 (*A. Townsend*), 1 ♀; ibidem, xi. 1939, 1 ♂; ix. 1940, ex *Acacia*, 1 ♂; 15.iii.1941, 1 ♀; xii. 1950, 1 ♀ (all NMK, Nairobi).



*Zamarada consecuta* Prout

(Text-figs 35, 36; Pl. 7, figs 479, 480; Pl. 96, figs 857, 858)

*Zamarada consecuta* Prout, 1922 : 179, pl. 1, fig. 22. Holotype ♂, TRANSVAAL (TM, Pretoria) [examined].*Zamarada consecuta* Prout; Janse, 1932 : 142, pl. 2, fig. 15.

♂ genitalia (Text-figs 35, 36). Uncus acutely tapered, base with long setae dorsally. Ventral plate of gnathus trapezoid, apical margin shallowly incised. Valve simple, apex broadly rounded; dorsal process with smoothly edged, triangular projection at three-fourths. Fulcrum longer than aedeagus, apex spatulate and coarsely scobinate; aedeagus finely tapered with minute, thorn-like projection at one side near apex. Vesica with a cluster of short spines.

♀ genitalia (Pl. 7, figs 479, 480). Sterigma asymmetrical; lamella antevaginalis with finely tapered process extending posteriorly at right side. Posterior third of corpus bursae sclerotized and ribbed; signum stellate.

Measurements. Fore wing: ♂ 12.5–15.0 mm; ♀ 13.5–16.0 mm. Antennal pectinations. ♂ 12 ×, ♀ 3 × diameter of shaft.

Externally closely similar to *mesotaenia*; differs in the more even, rather paler irroration of the wings and in the absence of the broad medial fascia from the fore wing (Pl. 96, figs 857, 858). Structurally the form of the uncus, ventral plate of the gnathus and the dorsal process of the valve in the male genitalia and the form of the asymmetrical sterigma in the female genitalia are diagnostic.

DISTRIBUTION. Rhodesia, Transvaal.

## MATERIAL EXAMINED.

*Zamarada consecuta* Prout, holotype ♂, TRANSVAAL: Barberton, 19–26.iii.1920 (A. Rob. G. v. D.), genitalia slide G.9146, Type no. 2405 in TM, Pretoria.

TRANSVAAL: Pretoria, viii. 1913 (Gladstone), 1 ♀ (*Zamarada consecuta* Prout, paratype) (BMNH); Pretoria N., 30.ix.1937 (G. van Son), 1 ♀; ibidem, 5.x.1937, 1 ♀; 25.x.1937, 1 ♂; xii. 1943, 1 ♂, 1 ♀; Rustenburg, i.1958 (D. W. Rorke), 1 ♂; Limburg, Potgietersrus Distr., 9–10.xii.1964 (Vári & Potgieter), 1 ♂, 3 ♀ (all TM, Pretoria); Waterberg Dist., Zutzencka, 1.iii.1899, 1 ♂; Johannesburg (J. P. Cregoe), 1 ♂, 1 ♀ (all BMNH). RHODESIA: Marandellas, x, 1 ♂ (NMR, Bulawayo).

*Zamarada deceptrix* Warren

(Text-figs 37, 38; Pl. 8, figs 481, 482; Pl. 97, figs 859–861)

*Zamarada deceptrix* Warren, 1914 : 485. Holotype ♀, NATAL (SAM, Cape Town) [examined].*Zamarada deceptrix* Warren; Janse, 1932 : 143.

♂ ♀ (Pl. 97, figs 859–861). Hyaline area of each wing and buff costa of fore wing irrorate with dark grey and black; postmedial fascia, forming distal border of hyaline area, slender and black edged distally with scattered silvery grey scales. Non-hyaline terminal third of each wing yellowish brown to light brown, varyingly irrorate with black and shades of grey; in the form most commonly represented in the material available for study, the dark irroration is concentrated in the apical third of each wing; subterminal fascia dark grey, dentate and broken, most clearly indicated by the distal edging of silvery grey scales.

♂ genitalia (Text-figs 37, 38). Uncus curved ventrad and tapered; base with long setae dorsally. Ventral plate of gnathus strongly sclerotized and tapered, curved dorsad. Dorsal process of valve narrowed at five-sixths; apex hammer-headed, ventral tip rounded, dorsal tip angled; dorsal processes symmetrical. Fulcrum longer than aedeagus, slender and scobinate in apical fourth; aedeagus finely tapered with a minute, thorn-like projection at one side just below apex. Vesica with a slender cluster of short spines.

♀ genitalia (Pl. 8, figs 481, 482). Ductus bursae tubular, sclerotized and ribbed, shaped in form of letter C. Corpus bursae spherical with an ovate or circular stellate signum.

Measurements. Fore wing: ♂ 10.5–13.0 mm; ♀ 11.5–15.5 mm. Antennal pectinations: ♂ 13 ×, ♀ 4 × diameter of shaft.

With the closely similar species *delosis* which follows, distinguished externally from related species in well marked specimens by the pattern and colour of the non-hyaline terminal area of each wing. Distinct structurally in the form of the strongly sclerotized, beak-like ventral plate of the gnathus and the form of the symmetrical dorsal processes of the valve in the male genitalia and in the form of the sterigma, ductus bursae and corpus bursae in the female genitalia.

DISTRIBUTION. Ethiopia, Uganda, W. Kenya, Mozambique, Zambia, Rhodesia, Transvaal, Botswana, Natal, Cape Province.

#### MATERIAL EXAMINED.

*Zamarada deceptrix* Warren, holotype ♀, NATAL: Durban, ix. 1887 (*J. H. Bowker*), in SAM, Cape Town.

ETHIOPIA: Daroli, Arussi Galla, 7.iii.1901 (*C. V. Erlanger*), 1 ♀. UGANDA: Ankole, 30.v.1929 (*J. Gastrell*), 1 ♂; ibidem, 12.vi.1929, 1 ♂ (all BMNH); Nsongesi, Kagera R., ix. 1962 (*G. Cole*), 1 ♀ (NMK, Nairobi). KENYA: Kacheliba, W. Suk, iv. 1961 (*T. H. E. Jackson*), 1 ♀ (BMNH); Nakuru, bred, 28.vi.1941 (*A. Townsend*), 1 ♂; ibidem, 17.vi.1950, 1 ♂ (both NMK, Nairobi); Suna, S. Kavirondo, i. 1932 (*W. Feather*), 1 ♀ (BMNH). MOZAMBIQUE: Makulane (*Audeoud*), 1 ♂, 1 ♀ (BMNH); Magude, 10.xi.1918 (*C. J. Swierstra*), 1 ♀ (BMNH). ZAMBIA: 8 miles N. of Livingstone, 25–28.v.1954 (*A. J. T. Janse*), 1 ♀ (TM, Pretoria). RHODESIA: 15 miles S. of Wankie, 30.iv.1954 (*A. J. T. Janse*), 1 ♂, 1 ♀ (TM, Pretoria); 96 miles S.E. of Nuanetsi, 21°55' S. 31°30' E., iv. 1961, 1 ♂, 1 ♀; Khami, nr Bulawayo, xi. 1956, 1 ♂; 17 mls S. of Chiturapadzi, Limpopo R., 28–29.iv.1968 (*E. Pinhey*), 2 ♂ (all NMR, Bulawayo). TRANSVAAL: Kruger National Park Survey, Pafuri, 1.xii.1964 (*Vári & Potgieter*), 6 ♂, 5 ♀; ibidem, 24–28.iv.1961 (*D. W. Rorke*) 1 ♀; Punda Milia, 21–23.xi.1961 (*Vári & Rorke*), 1 ♀; Shingwedzi, 19–20.xi.1961 (*Vári & Rorke*), 1 ♂; Sakara, 20.iv–2.v.1968 (*Potgieter & Goode*), 1 ♂; Skukuza, ii–iv (*Janse, Vári, Potgieter & Goode*), 14 ♂, 29 ♀; Malelane, 3–5.xii.1963 (*L. Vári*), 1 ♂, 1 ♀; Limburg, Potgietersrus Distr., 9–10.xii.1964 (*Vári & Potgieter*), 1 ♂ (all TM, Pretoria). BOTSWANA: Bakgatla, Sebele, 10.vii.1969, 1 ♂ (BMNH). NATAL: Lebombo Mts., Jozini Dam, 9–14.i.1965 (*L. Vári*), 1 ♂, 1 ♀; Nyalazi Forest, 25–28.iii.1968 (*Potgieter & Goode*), 1 ♀; Ndumu, 10–12.ii.1968 (*Potgieter & Jones*), 8 ♂, 32 ♀; Dukuduku, 22–24.iii.1968 (*Potgieter & Goode*), 3 ♂, 6 ♀; Hluhluwe, x.1963 (*K. M. Pennington*), 1 ♀; Muden, 11.i.1954 (*H. Cookson*), 1 ♂; Durban, ii, vi, ix, 1 ♂, 2 ♀ (all TM, Pretoria);

Durban, ix. 1958 (C. G. C. Dickson), 1 ♀ (BMNH); Umgababa R., ix. 1927 (H. W. Bell), 1 ♀ (BMNH). CAPE PROVINCE: Umgazi River Mouth, 8-29.xi.1952 (Mrs C. Granville), 1 ♀ (TM, Pretoria).

### *Zamarada delosis* sp. n.

(Text-figs 39, 40; Pl. 8, figs 483, 484)

Externally similar to small specimens of *deceptrix*; in some examples the hyaline area of each wing is irregularly suffused with black.

♂ genitalia (Text-figs 39, 40). Distinguished from *deceptrix* by the asymmetrical dorsal processes of the valves; that on the right valve is closely similar to the corresponding process in *deceptrix*; the process on the left valve is twice as broad in the basal half as that on the right side and is then shaped as in Text-fig. 39.

♀ genitalia (Pl. 8, figs 483, 484). Distinguished from those of *deceptrix* by the presence of an acicular projection from the right-hand posterior margin of the sterigma.

Measurements. Fore wing: 11-12 mm; ♀ 11.0-12.5 mm. Antennal pectinations: ♂ 11 ×, ♀ 3 × diameter of shaft.

DISTRIBUTION. E. Kenya, E. Tanzania, N.E. Mozambique.

Holotype ♂, TANZANIA: Minaki [7°53' S. 39°47' E.], 6.xi.1964 (N. G. G. Webb), Geometridae genitalia slide no. 6833, in BMNH.

Paratypes. KENYA: Tana R., 3800 ft, 1.i.1899 (R. Crawshaw), 1 ♀ (BMNH); Makindu, i. 1960 (R. Carcasson), 1 ♂ (NMK, Nairobi), 2 ♂, 1 ♀ (BMNH); Kibwezi, 17.i.1917 (W. Feather), 1 ♀; ibidem, xii. 1921 (Dummer), 1 ♀; Mtito Andei, xii. 1950 (E. Pinhey), 1 ♀ (all BMNH). TANZANIA: Old Shinyanga, 17.vi.1953 (E. Burtt), 1 ♂ (BMNH); Mombo, 1 ♀ (MNHU, Berlin); E. Usambara, Amani, xi. 1965, 1 ♂ (NMK, Nairobi), 1 ♂ (BMNH); ibidem, i (G. Pringle), 1 ♂; xii, 1 ♀ (BMNH); Kilosa, 11.i.1926, at light (N. C. E. Miller), 1 ♀; Minaki, x-xi (N. G. G. Webb), 4 ♀ (all BMNH); Tendaguru, iv-v. 1909 (Janensch), 1 ♀ (MNHU, Berlin); ibidem, 21.iv.1925 (W. E. Cutler), 1 ♀ (BMNH). MOZAMBIQUE: Salone R., 25 miles S. of Marrumeu, 8-10.xi.1967 (E. Pinhey), 3 ♂, 5 ♀ (NMR, Bulawayo); Xiluvo, Vila Machado Distr., 9-10.iii.1964 (van Son & Vári), 1 ♂, 1 ♀ (TM, Pretoria); Chiluvo Hills, x. 1963, 2 ♀ (NMR, Bulawayo), 1 ♂ (BMNH); Dondo Forest, 2.xi.1963, 1 ♀ (NMR, Bulawayo).

### THE PULVEROSA-GROUP

Species included in the group are small, with a fore wing length of 8.5-15.0 mm; the non-hyaline terminal areas of the wings are usually greyish yellow to sepia. In the male genitalia the uncus is short, with long setae dorsally at base; the ventral plate of the gnathus is well developed; the valve is simple and membranous with a tapered dorsal process, which is either dilate or bears a projection at one-half to two-thirds; the projection may be serrate-edged and the processes are sometimes asymmetrical; aedeagus usually spined or toothed at one side near apex (smooth in *ochrata*); fulcrum well developed, except in *melasma*. Vesica with a short, thorn-like cornutus. In the female genitalia the sterigma is well developed; the corpus bursae is almost entirely membranous with a stellate signum. In the male

the hind tibia is dilate, except in *erugata*, enclosing a tuft of long hair-scales. Distinguished from the many similar-looking species in the *minimaria*-group by the dilate hind tibia of the male and by the presence on the vesica of a single, thorn-like cornutus in place of the cluster of cornuti found in species of that group.

KEY TO SPECIES

- 1 Dorsal process of valve cygnate, broadened at two-thirds, then tapered, smooth-edged and without projection . . . . . 2
- Dorsal process of valve serrate-edged in part or with spatulate projection at one-half to two-thirds, the projection digitate or triangular, serrate-edged or smooth . . . . . 3
- 2 (1) Apex of uncus tapered to distinctly truncate tip. Apical fourth of aedeagus coarsely scobinate on dorsal surface. Ventral plate of gnathus broadly rounded . . . . . *hyalinaria* (p. 57)
- Apex of uncus tapered to a point. Aedeagus smooth-surfaced. Ventral plate of gnathus tapered to narrowly rounded apex . . . . . *ochrata* (p. 58)
- 3 (1) Scobination on apical half of aedeagus as long as or longer than cornutus. Projection from dorsal process of valve triangular, weakly serrate along posterior margin . . . . . *psammites* (p. 56)
- Scobination on apical half of aedeagus often coarse and strongly sclerotized, but minute. If the projection from the dorsal process of the valve is triangular, it is either entirely smooth-edged or only the anterior margin is serrate . . . . . 4
- 4 (3) Dorsal process of valve with entirely smooth-edged, triangular process at one-half . . . . . 5
- Dorsal process of valve not so formed; if triangular in shape, then coarsely serrate along anterior margin . . . . . 6
- 5 (4) Triangular projection from dorsal process of valve sharply angled at apex. Fulcrum almost twice as long as aedeagus, apex finely and minutely serrate . . . . . *delta* (p. 55)
- Triangular projection from dorsal process of valve rounded at apex. Fulcrum a little longer than aedeagus (ratio 9 : 8), apex densely long-spined. . . . . *erugata* (p. 46)
- 6 (4) Projection from dorsal process digitate, spatulate and smooth-edged, apex smoothly rounded. Fulcrum not extending beyond apex of aedeagus . . . . . 7
- Projection from dorsal process not so formed; if digitate, then apical margin serrate. Fulcrum extending beyond apex of aedeagus . . . . . 8
- 7 (6) Uncus tapered to point. Apex of ventral plate of gnathus dilate and discoid. Fulcrum three-eighths as long as aedeagus, apex tapered to a point . . . . . *melasma* (p. 59)
- Uncus very broad, almost rectangular, for two-thirds of its length, apical third tapered to minute, pointed tip. Ventral plate of gnathus evenly tapered to narrowly rounded tip. Fulcrum one-half as long as aedeagus, apex hammer-headed and coarsely scobinate . . . . . *ilma* (p. 60)
- 8 (6) Ventral surface of dorsal process of valve evenly curved from base to apex; dorsal surface coarsely and irregularly serrate from one-fourth to five-eighths. Uncus sharply narrowed at one-third, apical two-thirds produced and of even width to tip, the width equal to that of apical fourth of dorsal process. Apex of fulcrum dilate and densely spined, 3-4 spines one and one-half times as long as width of aedeagus . . . . . *prionotos* (p. 48)
- Ventral surface of dorsal process of valve more or less cygnate. Uncus evenly narrowed to one-half, then more slenderly produced, or evenly tapered, to apex. Apex of fulcrum not ornamented with long spines . . . . . 9



- 9 (8) Dorsal process of each valve cygnate, smooth-edged on ventral surface and with serrate-edged projections on dorsal surface; processes asymmetrical . . . 10
- Dorsal process of valve cygnate with serrate or scobinate-edged projection on dorsal surface; processes symmetrical . . . 11
- 10 (9) Dorsal surface of left-hand process serrate from one-third to two-thirds and angled at one-half (Text-fig. 59). Distribution: northern subtropics *torrida* (p. 53)
- Dorsal surface of left-hand process serrate and usually shallowly excavate between one-third and two-thirds (Text-fig. 61). Distribution: South West Africa . . . *tosta* (p. 54)
- 11 (9) Projection from dorsal process of valve in form of equilateral triangle based on process, anterior margin serrate . . . 12
- Projection from dorsal process of valve not so formed . . . 13
- 12 (11) Posterior margin of triangular projection smooth and straight; anterior margin serrate with a slender, setose, digitate process situate at its base (Text-fig. 41) . . . *chrysothyra* (p. 42)
- Posterior margin of triangular projection smooth and shallowly concave; serrate anterior margin without process at base (Text-fig. 43) . . . *amicta* (p. 44)
- 13 (11) Dorsal process of valve weakly cygnate, little more than sinuous; serrate-edged projection slender and digitate (Text-figs 53, 55-58). Apex of ventral plate of gnathus broadly rounded . . . 15
- Dorsal process of valve strongly cygnate, almost Z-shaped; serrate-edged projection as broad as and parallel with middle third or fourth of process. Apex of ventral plate of gnathus tapered and narrowly rounded . . . 14
- 14 (13) Serrate-edged projection as broad as and parallel with middle third of dorsal process, anterior margin of projection straight (Text-fig. 47). Apex of fulcrum tipped with 3-5 stout spines . . . *metallicata* (p. 45)
- Serrate-edged projection as broad as and parallel with middle fourth of dorsal process, anterior margin of projection slightly concave (Text-fig. 45). Apex of fulcrum tipped with 1-2 stout spines . . . *ordinaria* (p. 45)
- 15 (13) Non-hyaline terminal third of each wing very shallowly excavate by hyaline area between veins  $M_3$  and  $Cu_{1b}$  (Pl. 98, fig. 873) . . . *ascaphes* (p. 52)
- Non-hyaline terminal third of each wing deeply excavate by hyaline area between veins  $M_3$  and  $Cu_{1b}$  (Pl. 98, figs 870-872) . . . *pulverosa* (p. 48)

### *Zamarada chrysothyra* Hampson

(Text-figs 41, 42; Pl. 97, fig. 862)

*Zamarada chrysothyra* Hampson, 1909 : 122, pl. 4, fig. 50. Holotype ♂, UGANDA (BMNH) [examined].

♂ (Pl. 97, fig. 862). Hyaline area of wings creamy buff sparsely irrorate with brown and grey and finely edged distally with brown, grey and black; antemedial fascia brown irrorate with grey; discal spot on fore wing pale grey, dark edged, that on hind wing black and minute. Costa of fore wing and non-hyaline terminal third of each wing pale yellow (pl. 4, A3, cream) irrorate and patterned with dark brown and black, as illustrated; dentate subterminal fascia yellowish brown to dark brown, broad but ill-defined, densely irrorate with black between veins  $M_1$  and  $M_3$  on each wing and at tornal angle of fore wing. In some examples the black irroration in the subterminal area of the fore wing extends to the apex. Termen spotted interneurally, the spots extended to streaks between veins  $R_5$  and  $M_3$  on fore wing and between  $M_1$  and  $M_3$  on hind wing. Underside of non-hyaline terminal area uniformly dark brown almost to termen, then buff.

♂ genitalia (Text-figs 41, 42). Uncus digitate. Ventral plate of gnathus as long as uncus,

apex tapered to rounded tip, surface minutely scobinate. Dorsal process of valve with triangular projection at one-half, anterior margin serrate; a short, setose, digitate process at base of serrate edge. Fulcrum extending beyond aedeagus, tip broadened and densely spined. Aedeagus with a scobinate ridge at one side in apical third. Thorn-like cornutus on vesica subequal in length to width of aedeagus.

♀ unknown.

Measurements. Fore wing: 10.5–12.0 mm. Antennal pectinations: 11 × diameter of shaft.

Distinguished externally from closely related species in the *pulverosa*-group by the pale yellow colour of the wing with the strongly contrasting black subterminal markings and structurally by the form of the projection on the dorsal process of the valve, which bears an additional short, setose process at the base of its serrate edge.

DISTRIBUTION. Uganda, Nigeria.

#### MATERIAL EXAMINED.

*Zamarada chrysothyra* Hampson, holotype ♂, UGANDA: S. E. Ruwenzori [Mokia], 3500 ft, 28.vi.1906 (*Hon. G. Legge & A. F. R. Wollaston*), Geometridae genitalia slide no. 1666, in BMNH.

UGANDA: Ankole, Kayonza, v. 1958 (*J. R. F. Mills*), 1 ♂; Bwamba, v. 1958 (*R. Carcasson*), 1 ♂ (both NMK, Nairobi); Masaka, Buddu, Lwengo, 4200 ft, 24.v.1935 (*H. B. Johnston*), 1 ♂ (ARS, Kawanda). NIGERIA: north, Zungeru, 26.iv.1911 (*Scott Macfie*), 1 ♂ (BMNH).

#### *Zamarada secutaria* (Guenée)

(Pl. 9, figs 487, 488; Pl. 97, fig. 863)

*Stegania secutaria* Guenée, 1857a : 45. Holotype ♀, ETHIOPIA (MNHN, Paris) [examined].

♀ (Pl. 97, fig. 863). Hyaline area of wings irrorate with greyish yellow; medial fascia on fore wing greyish yellow (pl. 4, B5, golden wheat) passing through discal spot, which is grey outlined with dark brown; discal spot on hind wing minute, dark brown. Non-hyaline terminal area of each wing light yellow (pl. 4, A4) irrorate proximally, especially in discal area of fore wing, with greyish yellow. Underside of non-hyaline terminal area similar to upperside.

♀ genitalia (Pl. 9, figs 487, 488). Sterigma asymmetrical, operculum at right side; lamella antevaginalis extending further posteriorly on right side than on left, posterior margin dentate at right side and just to left of centre. Ductus bursae sclerotized, more extensively at right side.

♂ unknown.

Measurements. Fore wing: 16–17 mm. Antennal pectinations: 3 × diameter of shaft.

Closely similar in colour and pattern to some examples of *ordinaria*, but having an outlined discal spot on the fore wing instead of a small, solid dot. Structurally distinct in the form of the sterigma, but closely akin both to *ordinaria* and to *amicta*.

DISTRIBUTION. Ethiopia.

#### MATERIAL EXAMINED.

*Stegania secutaria* Guenée, holotype ♀, ETHIOPIA, in MNHN, Paris.

ETHIOPIA: Takusa, 6 miles S.W. of Lake Tana, 6000 ft, 7.xi.1926 (*R. E. Cheeseman*), 1 ♀ (BMNH).

### *Zamarada amicta* Prout

(Text-figs 43, 44; Pl. 9, figs 485, 486; Pl. 97, fig. 864)

*Zamarada amicta* Prout, 1915 : 344. LECTOTYPE ♂, KENYA (BMNH), here designated [examined].

♂ ♀ (Pl. 97, fig. 864). Closely similar in some of its forms to *chrysothyra*; hyaline area of wings usually more densely irrorate with yellowish brown; yellowish brown medial fascia, curved distad of discal spot, usually developed; discal spot on fore wing often less markedly dark-ringed. Underside of non-hyaline terminal area less extensively dark brown than in *chrysothyra*, the dark shade often concentrated in apical area of each wing.

♂ genitalia (Text-figs 43, 44). Uncus laterally compressed and tapered apicad. Ventral plate of gnathus as long as uncus, apex tapered to rounded tip, surface minutely scobinate. Dorsal process of valve stout in basal half with triangular projection at one-half, the anterior margin serrate, the posterior margin concave. Fulcrum seven-eighths as long as aedeagus, the apex bearing three stout and four minute thorn-like spines. The form and the degree of serration of the anterior margin of the triangular projection from the dorsal process of the valve varies a little, but the concavity of its posterior margin is well defined in the six slides studied.

♀ genitalia (Pl. 9, figs 485, 486). Sterigma asymmetrical, posterior margin with short, stout digitate process medially, inclined anteriorly; projection from right side of posterior margin of lamella postvaginalis markedly longer than that from left. Corpus bursae sclerotized at right side posteriorly.

Measurements. Fore wing: ♂ 10.5–12.0 mm; ♀ 12 mm. Antennal pectinations: ♂ 12 ×, ♀ 1.5 × diameter of shaft.

Distinguished structurally from *chrysothyra* in the male by the blade-like apex of the uncus, by the less heavily spined apex of the fulcrum and by the form of the dorsal process of the valve, notably in its stouter basal half, the concave posterior margin of its triangular projection and the absence of a short, setose, digitate process from the base of its serrate anterior margin. The female of *chrysothyra* is not known.

DISTRIBUTION. W. Kenya, Uganda, Burundi, Zaire.

#### MATERIAL EXAMINED.

*Zamarada amicta* Prout, lectotype ♂ here designated, KENYA (Brit. E. Africa): N. Kavirondo, Maramas Dist., Ilala, 4500 ft, 20.vi.1911 (*S. A. Neave*), 1912–92, *Zamarada amicta* Prout type, Geometridae genitalia slide no. 5900, in BMNH.

KENYA: Kibwezi, v. 1960 (*R. H. Carcasson*), 1 ♀ (NMK, Nairobi); Mt Elgon, xi. 1952 (*T. H. E. Jackson*), 1 ♀ (NMK, Nairobi); ibidem, xii, 1951, 1 ♂ (BMNH); lectotype data, Geometridae genitalia slide no. 1949–139, 1 ♂ (paralectotype of *Zamarada amicta* Prout) (BMNH); Malaba Forest, vi. 1957 (*C. R. Howard*), 1 ♂ (NMK, Nairobi). UGANDA: Kalinzu Forest, ii. 1950 (*J. G. Williams*), 1 ♂; Mabera Forest, viii. 1920 (*R. A. Dummer*), 2 ♂; ibidem, Kyagive, Mulange, iv–viii, 1 ♂; Mubende, v. 1956 (*R. Carcasson*), 2 ♂; Semliki Forest, 2850 ft, 22.viii–3.ix.1952 (*D. S. Fletcher*), 1 ♂ (all BMNH). BURUNDI: E. Rusizi Valley, N. Lake Tanganyika,

3000 ft, i. 1924, wet season (*T. A. Barns*), 1 ♂ (BMNH). ZAIRE (Belgian Congo): Upper Uele dist., Dungu, iv, 1 ♂ (BMNH).

***Zamarada ordinaria* Bethune-Baker**

(Text-figs 45, 46; Pl. 10, figs 491, 492; Pl. 97, figs 865, 866)

*Zamarada ordinaria* Bethune-Baker, 1913 : 573. Holotype ♂, ANGOLA (BMNH) [examined].

*Zamarada medianata* Prout, 1915 : 343. Holotype ♀, RHODESIA (BMNH) [examined]. **Syn. n.**

*Zamarada medianata* Prout; Janse, 1932 : 135, pl. 1, fig. 26.

♂ ♀ (Pl. 97, figs 865, 866). Non-hyaline terminal area of each wing greyish orange, very lightly irrorate with yellowish brown and dark brown, in this respect differing from *chrysothyra* and from *amicta*; some dark brown to black irroration between veins  $M_1$  and  $M_3$  on each wing, at tornus of fore wing and at anal angle of hind wing. In the hyaline area the medial fascia is present in some examples, curved distally round each discal spot, but ill-defined, yellowish brown to black; discal spots minute and black, without pale centres.

♂ genitalia (Text-figs 45, 46). Closely similar to *amicta* in the form of the uncus, gnathus and valve, but differing in the form of the projection from the dorsal process of the valve in which the longer serrate margin is equal to and parallel with the middle fourth of the process and the anterior margin is slightly concave; differs also in the apex of the fulcrum, which bears only one or two stout spines.

♀ genitalia (Pl. 10, figs 491, 492). Closely similar to those of *amicta*, differing in the form of the sterigma, in which the anterior margin is smooth and straight with a clearly defined, sclerotized fold.

Measurements. Fore wing: ♂ 10.5–12.0 mm; ♀ 12–15 mm. Antennal pectinations: ♂ 12 ×, ♀ 3 × diameter of shaft.

DISTRIBUTION. Zaire (Katanga), Rhodesia, Transvaal, Natal, Angola.

**MATERIAL EXAMINED.**

*Zamarada ordinaria* Bethune-Baker, holotype ♂, ANGOLA: north, N'Dalla Tando, 2700 ft, 23.xi.1908 (*Dr W. J. Ansorge*), Geometridae genitalia slide no. 1695, in BMNH. *Zamarada medianata* Prout, holotype ♀, RHODESIA: Selukwe, vii–viii. 1914 (*F. W. Short*), Geometridae genitalia slide no. 3633, in BMNH.

ZAIRE (Belgian Congo): Elisabethville, i. 1937 (*Ch. Seydel*), 1 ♂ (MRAC, Tervuren); ibidem, 2.ii.1959, 1 ♀ (BMNH). RHODESIA: Mountain Inn, Melssetter, xi. 1950 (*H. B. Kettlewell*), 1 ♂ (BMNH); Marandellas, i. 1962, 1 ♂; Salisbury, xii. 1962, 1 ♂; ibidem, i. 1963, 1 ♂; ibidem, 18.i.1966 (*A. J. Duke*), 1 ♀ (all NMR, Bulawayo); Zimbabwe, 6–10.iv.1954 (*A. J. T. Janse*), 5 ♂, 3 ♀ (TM, Pretoria). TRANSVAAL: Pretoriusskop, 1.iv.1952 (*L. Vári*), 1 ♀; ibidem, 24–25.iv.1968 (*Potgieter & Goode*), 1 ♀; Louis Trichardt, 6.iv.1955 (*L. Vári*), 1 ♂ (all TM, Pretoria). NATAL: Lower Umkomaas (*G. F. Leigh*), 1 ♀ (BMNH).

***Zamarada metallicata* Warren**

(Text-figs 47, 48; Pl. 10, figs 489, 490; Pl. 98, fig. 869)

*Zamarada metallicata* Warren, 1914 : 486, pl. 41, fig. 14 [poor figure]. Holotype ♀, ZULULAND (SAM, Cape Town) [examined].

*Zamarada metallicata* Warren; Janse, 1932 : 142, pl. 1, fig. 31, not text-fig. 39.



♂ ♀ (Pl. 98, fig. 869). Hyaline area of each wing densely irrorate with grey and black and finely edged distally with black and silvery grey; antemedial fascia on fore wing black; medial fascia, when marked, ill defined brownish orange and black; discal spot on fore wing silvery grey outlined with black, that on hind wing black. Proximal fourth of fore wing and non-hyaline terminal area of each wing yellowish brown irrorate with brownish orange, grey and black; subterminal fascia silvery grey broadly bordered proximally with brownish orange. Such typical examples may be distinguished by their colour and pattern. In paler examples, which resemble *deceptrix* Warren, much of the brownish orange colour is wanting; males of such examples may be distinguished externally by the dilate hind tibia. Rarely the proximal fourth of the fore wing and the distal third of each wing are predominantly brownish orange. Under-side of non-hyaline terminal area dark greyish brown.

♂ genitalia (Text-figs 47, 48). Uncus, gnathus and valve similar to those of *amicta* and *ordinaria*. Form of strongly cygnate, almost Z-shaped, dorsal process on valve diagnostic; serrate-edged projection as broad as and parallel with middle third of process. Fulcrum one and one-half times as long as aedeagus, apical half cygnate and tipped with 3-6 spines. Aedeagus only weakly scobinate at one side in apical third.

♀ genitalia (Pl. 10, figs 489, 490). Sterigma asymmetrical as in *amicta* and *ordinaria* and similarly variable in the precise form of the projection from the right-hand side of the lamella postvaginalis. The boldly and deeply curved anterior margin of the sterigma is diagnostic.

Measurements. Fore wing: ♂ 11.0-13.0 mm; ♀ 13.0-14.0 mm. Antennal pectinations: ♂ 12 ×, ♀ 2.5 × diameter of shaft.

DISTRIBUTION. Rhodesia, Transvaal, Natal, Cape Province, South West Africa.

#### MATERIAL EXAMINED.

*Zamarada metallica* Warren, holotype ♀, ZULULAND: M'fongosi, x. 1911 (W. E. Jones), in SAM, Cape Town.

RHODESIA: Salisbury, xii. 1955, 1 ♀; Marandellas, xii. 1961, 1 ♂; Khami near Bulawayo, i. 1955, 1 ♂; ibidem, iii. 1959, 1 ♂ (all NMR, Bulawayo); Selukwe, v. 1913 (F. W. Short), 1 ♀ (BMNH); Msali Bridge, 17-19.iv.1954 (A. J. T. Janse), 2 ♀ (TM, Pretoria). TRANSVAAL: Ofcolaco, 20 miles S. of Tzaneen, Letaba Dist., vii. 1962 (Mrs C. Granville), 1 ♀; ibidem, i. 1963, 1 ♂ (both TM, Pretoria); Wyliespoort [22°54' S. 29°56' E.] 2-10.xi.1920 (C. J. Swierstra), 2 ♂, 3 ♀ (BMNH); ibidem, 18-20.iii.1954 (A. J. T. Janse), 1 ♂ (TM, Pretoria); Roodeplaat [25°35' S. 28°21' E.] 22.ii.1920 (Dr Breyer), 1 ♂ (BMNH); Pretoria N., ix. 1946 (G. van Son), 1 ♀; Pretoria, 6-26.v.1958 (R. B. Copley), 2 ♂; Waterval-Boven, 16-17.iii.1967 (Potgieter & Goode), 1 ♂, 6 ♀ (all TM, Pretoria); Barberton, 19-26.iii.1920, 1 ♀ (BMNH); ibidem, 14-18.x.1951 (A. J. T. Janse), 1 ♂ (TM, Pretoria). NATAL: Verulam (Spiller), 1 ♂ (MNHU, Berlin); Durban, 16.iii.1958 (C. G. C. Dickson), 1 ♀; ibidem, xi. 1955, 1 ♂ (both TM, Pretoria). CAPE PROVINCE: Port St. Johns, i. 1924 (R. E. Turner), 1 ♂ (BMNH); Butterworth, viii. 1954 (C. G. C. Dickson), 2 ♂; Worcester, xi. 1962 (R. C. Littlewood), 1 ♀. SOUTH WEST AFRICA: Asab, 5.v.1965 (J. H. Potgieter), 1 ♀ (all TM, Pretoria).

#### *Zamarada erugata* sp. n.

(Text-figs 49, 50; Pl. 11, figs 495, 496; Pl. 97, fig. 867)

♂ ♀ (Pl. 97, fig. 867). Hyaline area of wings weakly tinged with creamy white, sparsely irrorate with brown and grey at mid-posterior margin of each wing, the irroration sometimes

extending anteriorly to form an ill-defined medial fascia, and finely edged distally with pale yellow, then black and silvery grey; costa of fore wing pale yellow irrorate with brown and grey; discal spot on fore wing silvery grey, black-ringed, that on hind wing black and minute. Basal area of fore wing brownish grey irrorate with dark brown, that of hind wing dark brown. Non-hyaline terminal area of each wing brownish grey with dark brown to black interneural spots or streaks between veins  $R_4-M_3$  and between  $Cu_{1b}-2A$  on fore wing and between  $M_1-M_3$  on hind wing; subterminal fascia silvery grey edged proximally with yellowish brown interneural spots.

♂ genitalia (Text-figs 49, 50). Uncus and valve similar to those of *amicta*. Ventral plate of gnathus broader than that of *amicta*, the apex tapered and the surface minutely scobinate. Projection from dorsal process of valve triangular, apex narrowly rounded, the edges smooth. Fulcrum one and one-eighth times as long as aedeagus; apex dilate and heavily spined. Aedeagus lightly serrate at one side just below apex.

♀ genitalia (Pl. II, figs 495, 496). Sterigma asymmetrical with two broad plates at right-hand side, one dorsal, one ventral; anterior margin smooth, slightly concave with 2-3 folds just posterior of it. Signum large, equal in diameter to width of ductus bursa, and stellate.

Measurements. Fore wing: ♂ 10.5-12.0 mm; ♀ 12.0-12.5 mm. Antennal pectinations: ♂ 12 ×, ♀ 3 × diameter of shaft.

Externally similar to *chrysothyra* and to some examples of *amicta* and *pulverosa* Warren, though neither *chrysothyra* nor *amicta* is yet known from southern Africa. The males of *erugata* may be distinguished by the simple hind tibia, lacking the dilation and hair-pencil of those species and in the genitalia by the form of the projection from the dorsal process of the valve and the broad, heavily spined apex of the fulcrum. In the female genitalia the form of the sterigma and the large stellate signum are diagnostic.

DISTRIBUTION. Ethiopia, Kenya, Mozambique, Rhodesia, Transvaal, Natal, Cape Province.

Holotype ♂, MOZAMBIQUE: Makulane, 1909 (*Audeoud*), in BMNH.

Paratypes. ETHIOPIA: Addis Ababa, 28.v.1948 (*K. M. Guichard*), 1 ♂. KENYA: Mackinnon Road, iv. 1950 (*W. Hale*), 1 ♂; Nakuru, bred, 15.iii.1941 (*A. Townsend*), 1 ♂; ibidem, 29.v.1942, 1 ♂; vii. 1938, 1 ♂; 1.x.1942, 1 ♀; Ravine, xi. 1938 (*A. Townsend*), 1 ♀; Uganda Railway, Tsavo Road, 1500 ft, 24.iii.1911 (*S. A. Neave*), 1 ♂; Kibwezi, xii. 1921 (*Dummer*), 1 ♂ (all BMNH). RHODESIA: Msali Bridge, 17-19.iv.1954 (*A. J. T. Janse*), 1 ♂ (TM, Pretoria). TRANSVAAL: Kruger National Park, Pafuri, 1.xii.1964 (*Vári & Potgieter*), 1 ♀; K.N.P. Survey, Olifants Camp, 25-27.xi.1966 (*Potgieter & Goode*), 1 ♂; Satara, 29.iv-2.v.1968 (*Potgieter & Goode*), 1 ♂ (all TM, Pretoria). NATAL: Jozini Dam, Lebombo Mts, 9-14.i.1965 (*L. Vári*), 1 ♂; Yellowwoods, Balgowan, 5-7.i.1965 (*L. Vári*), 1 ♂; Durban, ix. 1952 (*C. G. C. Dickson*), 1 ♀; ibidem, xii. 1954, 1 ♂; 8.xii.1955, 1 ♂ (all TM, Pretoria); Lower Umkomaas (*G. F. Leigh*) 1 ♂ (BMNH); Nyalazi, vi. 1930 (*H. W. Bell-Marley*), 1 ♂; Ndumu, 10-12.i.1968 (*Potgieter & Jones*), 3 ♂, 1 ♀; Dukuduku, 22-24.iii.1968 (*Potgieter & Goode*), 1 ♀ (all TM, Pretoria). CAPE PROVINCE: Port St. Johns, xi. 1923 (*R. E. Turner*), 1 ♂ (BMNH); Kei River Bridge, 5-6.ii.1955 (*A. J. T. Janse*), 2 ♂ (TM, Pretoria).

*Zamarada prionotos* sp. n.

(Text-figs 51, 52; Pl. 11, figs 493, 494; Pl. 97, fig. 868)

♂ ♀ (Pl. 97, fig. 868). Hyaline area of wings irrorate with brown and finely edged distally with brownish yellow, then black and silvery grey; costa, posterior margin and proximal fourth of fore wing, proximal tenth of hind wing brownish yellow (pl. 5, C7-8) irrorate with brown (pl. 5, F4, sepia); antemedial fascia on fore wing slenderly black; broad, ill-defined medial fascia developed in posterior half of hind wing; discal spot on fore wing silvery grey edged with sepia, that on hind wing minute, sepia. Non-hyaline terminal area of each wing brownish yellow irrorate with sepia, densely in discal area distad of subterminal fascia and proximad of it in posterior half of hind wing; dentate subterminal fascia silvery grey edged proximally with patches of clear brownish orange. Underside of non-hyaline terminal area greyish brown, darker where the corresponding upperside pattern is densely sepia.

♂ genitalia (Text-figs 51, 52). Apical two-thirds of uncus slender and of even width, one-fifth as wide as basal third. Ventral plate of gnathus slender and scobinate, similar in length to uncus. Ventral surface of dorsal process of valve evenly curved from base to apex, dorsal surface coarsely and irregularly serrate from one-fourth to five-eighths. Aedeagus minutely serrate near apex on ventral surface. Fulcrum broadened and heavily spined at apex.

♀ genitalia (Pl. 11, figs 493, 494). Sterigma asymmetrical, anterior margin crenulate. Corpus bursae wholly membranous.

Measurements. Fore wing: ♂ 12.0-12.5 mm; ♀ 13.5 mm. Antennal pectinations: ♂ 10 ×, ♀ 8 × diameter of shaft.

Distinguished externally by the well contrasted brownish yellow and sepia pattern of the non-hyaline terminal area of each wing and structurally by the genitalia of both sexes. In the male the serrate-edged dorsal process on the valve and in the female the form of the sterigma are diagnostic.

DISTRIBUTION. Rhodesia.

Holotype ♂, RHODESIA: Mashonaland, Umtali (G. A. K. Marshall), Geometridae genitalia slide no. 6507, in BMNH.

Paratypes. RHODESIA: holotype data, 1 ♂ (BMNH); Umtali, 5.i.1918 (A. J. T. Janse), 1 ♂ (TM, Pretoria); Huntersroad, 12.xii.1917 (E. Whatley), 1 ♀ (BMNH).

*Zamarada pulverosa* Warren

(Text-figs 53-57; Pl. 12, figs 497-500; Pl. 98, figs 870-872; Map 1)

*Zamarada pulverosa* Warren, 1895 : 158. NEOTYPE ♂, CAPE PROVINCE (BMNH), here designated [examined].

*Zamarada pulverosa* Warren; Gaede, 1915 : 123, 145.

[*Zamarada secutaria* (Guenée) sensu Platt, 1921 : 131. Misidentification.]

*Zamarada pulverosa* Warren; Janse, 1932 : 143, pl. 2, fig. 4, text-fig. 39.

♂ (Pl. 98, figs 870, 871). Hyaline area of wings varyingly irrorate with brownish yellow; costa and posterior margin of fore wing light yellow irrorate with dark brown; antemedial fascia on fore wing dark brown edged distally with brownish yellow; medial fascia on each wing, when marked, broad and diffuse, dark brown irrorate with brownish yellow; postmedial fascia, forming distal margin of hyaline area, dark brown to black, slender and sharply marked, finely



edged proximally with light yellow and distally with silvery grey; discal spot on fore wing silvery grey ringed with black, that on hind wing minute and black. Non-hyaline terminal area of each wing greyish yellow irrorate with dark brown and black; subterminal fascia silvery grey irregularly banded proximally with brownish yellow.

♀. Two colour forms are well represented among the material available for study. In one the non-hyaline terminal area of each wing is greyish orange irrorate with reddish brown and dark brown; the proximal banding of the subterminal fascia is reddish orange.

In the second form the costa of the fore wing is reddish brown; the non-hyaline terminal area of each wing is light yellow densely irrorate with reddish brown and the proximal banding of the subterminal fascia is brownish yellow; the remainder of each wing is irrorate with silvery grey and dark brown.

Examples of both sexes from N.W. Cape Province (Springbok), from localities in the Orange River Valley (Aliwal North, Oranjekrag and a locality 12 miles N.E. of Petrusville) are very dark, the vestiture and wings being densely irrorate with black. The proximal banding of the subterminal fascia in the female is brownish orange, though this too may be obscured by dense black irroration (Pl. 98, fig. 872).

In general, examples from Transvaal, Natal and Cape Province dated August–October representing the vernal generation are larger and the hyaline areas of the wings are irrorate with dark scales; representatives of the aestival generations, dated December–February are smaller with little irroration on the wings.

♂ genitalia (Text-figs 53–57). Uncus tapered. Ventral plate of gnathus triangular, apex narrowly rounded. Dorsal process of valve stout in basal half, apical half shallowly curved; a strongly sclerotized, tapered projection, inclined towards middle of ninth tergite, arises at one-half dorsal process, the posterior margin smooth, the ventral margin varyingly serrate; in some examples the projections from the processes are asymmetrical. Fulcrum one and one-third times as long as aedeagus, apex scobinate and tipped with 3–4 stout spines. Aedeagus weakly serrate at one side just below apex. Three extreme forms of the projection from the dorsal process of the valve are illustrated (Text-figs 55, 56, 57); at first sight these appear to represent distinct species, but among three dozen genitalia preparations numerous intermediates, some asymmetrical, have precluded any clear division.

♀ genitalia (Pl. 12, figs 497–500). Sterigma asymmetrical, the right-hand side produced posteriorly as figured; lateral and anterior margins well sclerotized and smooth, anterior margin straight or slightly bowed with a fold; signum stellate, diameter equal to one-half to two-thirds of that of ductus bursae. From over thirty preparations of the genitalia of *pulverosa*, two main forms of the sterigma have been figured; in one example (Pl. 12, figs 497, 498) the anterior margin of the sterigma is curved and the left-hand side broadly rounded, in the other (Pl. 12 figs 499, 500) the anterior margin is straight and the left-hand side more narrowly rounded.

Measurements. ♂ 10.5–14.5 mm; ♀ 10.0–14.5 mm. Antennal pectinations: ♂ 12 ×, ♀ 4–6 × diameter of shaft. Some variation has been noted in the length of the pectinations in the female antennae; the longest pectinations have been found to vary from four to six times the diameter of the shaft.

Distinguished externally in the male from the sympatric *erugata* by the presence of a dilate hind tibia with a pencil of long hair scales and in typical examples from *metallicata* by the paler colour of the wings. In the female the longer pectinations of the antennae separate *pulverosa* from both *erugata* and *metallicata*. In the male genitalia the form of the dorsal process on the valve distinguishes *pulverosa*; in the female genitalia the form of the sterigma and the appreciably smaller signum distinguishes *pulverosa* from *erugata*; the form of the sterigma distinguishes it from *metallicata*.

Reared series or series collected with precise ecological data are needed to



evaluate the significance of the variation noted in the structure and colour of *pulverosa*. For the present no subdivision has been attempted.

**BIOLOGY.** E. E. Platt (1921 : 1931) recorded the larva, under the name *secutaria* Guenée, feeding on *Dichrostachys nutans* Benthham [= *D. cinerea* (Linnaeus) Wight & Arnott] (Leguminosae).

**DISTRIBUTION.** Mozambique, Rhodesia, Natal, Transvaal, Orange Free State, Cape Province, Botswana, South West Africa.

#### MATERIAL EXAMINED.

*Zamarada pulverosa* Warren was described from two female specimens in the Rothschild collection from South Africa. According to Prout's unpublished notes in the BMNH, the original specimens are lost; this conclusion has been confirmed by a further fruitless search. Gaede's note (1915 : 1923) that he had borrowed type-material is evidently based on a misunderstanding, for he was almost certainly loaned what were believed to be typical examples agreeing with the original description.

In order to stabilize the use of the name *pulverosa* a male neotype has been designated, the male displaying better diagnostic characters than the female.

*Zamarada pulverosa* Warren, neotype ♂, CAPE PROVINCE (Cape Col.): Annshaw, 98-249 [pres. by C. G. Barrett], Geometridae genitalia slide no. 1949-153, in BMNH.

**MOZAMBIQUE:** Dondo, 12.ix.1954 (*H. Cookson*), 1 ♂ (TM, Pretoria). **RHODESIA:** Selukwe, i,ii,viii. 1913 (*F. W. Short*), 3 ♂, 2 ♀ (BMNH); Sawmills, 1.iv.1923 (*R. Stevenson*), 1 ♀ (TM, Pretoria); Bulawayo, ix,x,xii, 1 ♂ (BMNH), 1 ♂, 2 ♀ (NMR, Bulawayo); Khami, Matabeleland, ix,xi,xii, 3 ♂, 1 ♀; Turk Mine, xii. 1957, 1 ♀; Hope Fountain, 4.iii.1918 (*N. Jones*), 1 ♀; ibidem, 14.ix.1916, 1 ♂, 1 ♀; Hillside, 5.xi.1922, 1 ♀ (all NMR, Bulawayo); Mt. Selinda, 8-9.iii.1954 (*H. Cookson*), 1 ♀; Msali Bridge, 17-19.iv.1954 (*A. J. T. Janse*), 2 ♀ (all TM, Pretoria). **TRANSSVAAL:** Zoutpansberg, Shilouvane, 1906 (*H. A. Junod*), 1 ♂, 2 ♀; Zoutpan, Pta, 4-10.ii.1929 (*G. v. Son*), 1 ♂ (all BMNH); Politsi, 14-28.ii.1963 (*H. Geertsema*), 1 ♀; Wylies Poort, 18-20.iii.1954 (*A. J. T. Janse*), 1 ♀; Kruger National Park Survey, Letaba Camp, 14-18.xi.1961 (*Vári & Rorke*), 4 ♀; K.N.P., Matjulwana, 5.xii.1963 (*L. Vári*), 1 ♀; K.N.P., Satara, 26.iv-1.v.1969 (*Potgieter & Strydom*), 1 ♀; Ofcolaco, 1-7.viii.1962 (*Mrs C. Granville*), 1 ♂ (all TM, Pretoria); Woodbush Vill., 11-15.xii.1909 (*C. J. Swierstra*), 2 ♀; Malta Forest, Pietersburg, i,ii. 1928 (*G. v. Son*), 6 ♂, 3 ♀; Potgietersrus, 23.iv.1923, 1 ♀ (all BMNH); Percy Fyfe Nat. Res., Potgietersrus Dist., 30.xi-1.xii.1966 (*Potgieter & Goode*), 2 ♀ (TM, Pretoria); Moorddrift, i. 1925 (*G. P. F. v. Dam*), 2 ♂; Nylstroom, 16-21.xii.1921 (*G. v. Dam*), 1 ♀ (all BMNH); Marble Hall, 7.v.1962 (*D. W. Rorke*), 1 ♀; Rustenburg, i,iii,viii,ix,xi,xii, 11 ♂, 12 ♀ (all TM, Pretoria); Pretoria North, ii,iii,x,xii, 2 ♂, 1 ♀ (BMNH), 4 ♀ (TM, Pretoria); Pretoria, i-iii,viii,ix, 5 ♂, 6 ♀ (TM, Pretoria), 2 ♀ (BMNH); Gezina, 13.x.1911 (*T. Jenkins*), 1 ♀ (BMNH); Waterval-Boven, 16-17.iii.1967 (*Potgieter & Goode*), 4 ♂, 1 ♀; Silverton, 10-15.ii.1965 (*J. Potgieter*), 2 ♀ (all TM, Pretoria); White River, viii. 1906 (*A. T. Cooke*), 1 ♀; Louwscreek, 14.iii.1920, 1 ♀; Barberton, i,iii,ix,xi,

2 ♂, 3 ♀ (BMNH), 1 ♂, 3 ♀ (TM, Pretoria); Fourteen Streams, Barberton Dist., 13-15.iii.1967 (*Potgieter & Goode*), 1 ♂, 1 ♀ (TM, Pretoria); Krugersdorp (*O. Ulbrich*), 1 ♀ (MNHU, Berlin), i. 1960 (*H. Geertsema*), 1 ♂ (TM, Pretoria); Makapansgat, 17.i.1960 (*R. B. Copley*), 1 ♂ (TM, Pretoria). NATAL: Jozini Dam, Lebombo Mts., 9-14.i.1965 (*L. Vári*), 1 ♀; Nyalazi Forest, 25-28.iii.1968 (*Potgieter & Goode*), 1 ♀; Hluhluwe, x. 1953 (*K. M. Pennington*), 1 ♀ (all TM, Pretoria); M'fongosi, x. 1911 (*W. E. Jones*), 1 ♀; Ladysmith, ii. 1953 (*A. H. Newton*), 1 ♀; Weenen, i-v, viii-xii, 18 ♂, 13 ♀; Estcourt (*J. M. Hutchinson*), 2 ♂ (all BMNH); Muden, i-iii (*H. Cookson*), 1 ♂, 5 ♀; New Hanover, Hardenb., viii. 1913 (*Janse*), 1 ♀ (all TM, Pretoria); Stanger (*J. Devlin*), 2 ♀ (BMNH); Verulam (*Spiller*), 3 ♂, 1 ♀ (BMNH), 1 ♂, 1 ♀ (MNHU, Berlin); Mt Edgecombe, xii. 1963 (*H. Cookson*), 1 ♀ (NMR, Bulawayo); Durban, i, iii, vi, xii, 1 ♂, 1 ♀ (BMNH), 1 ♂, 4 ♀ (TM, Pretoria); Natal Coast, xii. 1912 (*L. Hargreaves*), 1 ♀ (BMNH). ORANGE FREE STATE: 11 ♂, 7 ♀; Bloemfontein (*F. Eckersley*), 1 ♀ (all BMNH); Brandford, xi. 1919 (*Irving*), 1 ♀ (NMR, Bulawayo); Aliwal North, 15-17.x.1968 (*J. H. Potgieter*), 1 ♂, 1 ♀; P. K. le Roux, van der Kloof Dam, 15-21.xi.1968 (*Snyman & Strydom*), 1 ♂, 2 ♀; Oranjekrag, H. F. Verwoert Dam, 7-14.x.1968 (*J. H. Potgieter*), 28 ♂, 62 ♀; ibidem, 9-17.i.1969 (*Snyman & Strydom*), 2 ♂, 1 ♀ (all TM, Pretoria); CAPE PROVINCE: Port St. Johns, ii, vi-viii, 1 ♂ (TM, Pretoria), 1 ♂, 3 ♀ (BMNH); Transkei (*Miss Barrett*), 17 ♂, 11 ♀; Annshaw (*Miss Barrett*), 20 ♂, 14 ♀; Katberg, 4000 ft, iii, xii, 2 ♂, 2 ♀ (all BMNH); Kei River Bridge, 5-6.ii.1955 (*A. J. T. Janse*), 1 ♂; Butterworth, viii. 1954 (*C. G. C. Dickson*), 2 ♂, 1 ♀; East London, i, v, vi, ix-xii (*G. C. Clark*), 6 ♂, 11 ♀; Blaney, i, v (*G. C. Clark*), 1 ♂, 2 ♀; Cambridge, ii, x (*G. C. Clark*), 2 ♂, 1 ♀; Port Alfred, v. 1949 (*C. G. C. Dickson*), 1 ♀; Port Elizabeth, i. 1948 (*G. C. Clark*), 1 ♀; Kleine Monde (Bathurst Dist.), i. 1950 (*J. Omer-Cooper*), 2 ♀; Despatch, ix. 1951 (*C. G. C. Dickson*), 1 ♀; Coerney, 14.xi.1935 (*G. C. Clark*), 1 ♂ (all TM, Pretoria); Bedford (*Weale*), 1 ♂, 1 ♀ (BMNH); Grahamstown, 3 ♂, 2 ♀ (BMNH), iii. 1939 (*J. Omer-Cooper*), 1 ♀ (TM, Pretoria); Fort Beaufort, 31.xi.1947 (*J. S. Taylor*), 1 ♂; Queenstown, ix. 1949 (*C. G. C. Dickson*), 1 ♂; Sterkstroom, i. 1945 (*G. C. Clark*), 1 ♀ (all TM, Pretoria); Foot of Nieuwveld Mts., 5 miles N.W. Beaufort West (*Mrs Butt*), 2 ♂, 3 ♀; Prince Albert Road, viii. 1917 (*S. Haughton*), 1 ♂; ibidem, xi. 1931 (*R. E. Turner*), 3 ♂; Matjiesfontein, 1-18.xii.1928 (*R. E. Turner*), 1 ♂ (all BMNH); Seeweweekspoort, 4-6.xii.1968 (*Potgieter & Jones*), 1 ♂, 5 ♀; Montagu, 24.ix.1953 (*A. J. Duke*), 1 ♂; Pofadder, 11.ix.1961 (*R. G. Strey*), 1 ♂; Van Rhynsdorp, 5.viii.1944 (*C. G. C. Dickson*), 1 ♂; Sprinkbok, 25.ix.1962 (*C. G. C. Dickson*), 1 ♂; Soebatsfontein, 13-14.xi.1933; (*G. v. Son*), 2 ♂ (all TM, Pretoria). SOUTH WEST AFRICA: Aus, xii. 1929, 1 ♂, Voigts Grund, 1300 m, 15.xii.1933 (*Dr K. Jordan*), 1 ♂, 2 ♀; Naukluft Mts, 1300-1500 m, 7-10.xii.1933 (*Dr K. Jordan*), 2 ♂, 7 ♀ (all BMNH); Bullsipoort, iv, vi, vii, x, xi, 3 ♂, 7 ♀ (TM, Pretoria); Buellesport, foot of Naukluft Mts, 1400 m, 5.xii.1933 (*Dr K. Jordan*), 3 ♂, 3 ♀ (BMNH); Rehoboth Distr., Valencia Farm, 7-17.v.1965 (*J. H. Potgieter*), 2 ♂, 2 ♀ (TM, Pretoria); Windhoek, 1600 m, 19.i.1934 (*Dr K. Jordan*), 1 ♂; Hoffnung, E. of Windhoek, 1850 m, 9-23.x.1933 (*Dr K. Jordan*), 4 ♂, 1 ♀; ibidem, i, ii. 1934, 2 ♂, 3 ♀ (BMNH); Okahandja, i-iv, xii, 6 ♂, 6 ♀ (BMNH), 1 ♂, 1 ♀ (MNHU, Berlin); Otjosongombe. Waterberg, 1600 m, 5.xi.1933 (*Dr K. Jordan*), 2 ♀ (BMNH); Abachaus, Otjiwarongo Distr., viii. 1942 (*G. Meyer*), 1 ♀;

ibidem, 12.xii.1939, 1 ♂ (TM, Pretoria); Sissekab, N.W. of Otavi, 1300 m, 11.xi.1933 (*Dr K. Jordan*), 2 ♂; Grootfontein (*J. W. Justice*), 1 ♀ (all BMNH).

### *Zamarada ascapthes* Prout

(Text-fig. 58; Pl. 13, figs 501, 502; Pl. 98, fig. 873)

*Zamarada ascapthes* Prout, 1925 : 311. Holotype ♀, SOUTH WEST AFRICA (DEI, Eberswalde) [examined].

*Zamarada ascapthes* Prout; Prout, 1935 : 12.

♂ ♀ (Pl. 98, fig. 873). Hyaline area of each wing irrorate with grey and black, densely at one-third posterior margin of fore wing; postmedial fascia, forming distal margin of hyaline area, black-edged distally with silvery grey, sharply defined and only slightly bowed between veins  $M_3$  and  $Cu_{1b}$ ; discal spots silvery grey, that on fore wing ringed with black. Non-hyaline terminal area of each wing greyish yellow densely irrorate with grey and black; subterminal fascia broad and black, ill-defined proximally, dentate distally and edged with silvery grey; termen finely black; cilia chequered greyish yellow and dark grey. Underside of non-hyaline terminal area uniformly grey.

♂ genitalia (Text-fig. 58). Closely similar to those of *pulverosa*, differing slightly in the form of the sclerotized projection from the dorsal process of the valve, which is rather more slender and more finely serrate, the tip curved ventrad.

♀ genitalia (Pl. 13, figs 501, 502). Differs from those of *pulverosa* in the form of the sterigma, which is longer, being almost as long as broad, and having a concave anterior margin.

Measurements. Fore wing: ♂ 10.5–12.5 mm; ♀ 11–14 mm. Antennal pectinations: ♂ 10 ×, ♀ 2 × diameter of shaft.

Distinguished externally from *pulverosa* by the form of the postmedial fascia, which is markedly less bowed between veins  $M_3$  and  $Cu_{1b}$  and by the shorter antennal pectinations in the female, the longest being twice as long as the diameter of the shaft; in the female of *pulverosa* the pectinations are 4–6 times as long as the diameter of the shaft.

DISTRIBUTION. South West Africa; Cape Province, Botswana, Rhodesia.

#### MATERIAL EXAMINED.

*Zamarada ascapthes* Prout, holotype ♀, SOUTH WEST AFRICA ('D.S.W. Afrika'): Rehoboth (*A. Heyne*), in DEI, Eberswalde.

SOUTH WEST AFRICA: Gobabeb, No. 3 Game Reserve [70 miles S.E. Walvis Bay on Kaiseb River], 20–29.v.1965 (*J. H. Potgieter*), 3 ♂ (TM, Pretoria); Okahandja, 19–29.iii.1928 (*R. E. Turner*), 1 ♀; ibidem, 20.x.1935 (*F. Gaerdes*), 1 ♂; Rehoboth Dist., Valencia Farm, 7–17.v.1965 (*J. H. Potgieter*), 4 ♀; Abachaus [Otjiwarongo Dist.], 17.vii.1942 (*G. Meyer*), 1 ♂ (all TM, Pretoria). CAPE PROVINCE: Kalahari Gemsbok Park, Mata-Mata, 16.ii.1961 (*L. Vári*), 1 ♂ (TM, Pretoria). BOTSWANA: 25 miles E. of Tshane on Kang Road, 26.i.1967 (*T. G. C.-Gray*), 1 ♂; 13 miles W. of Kanye on Kang Road, 3.iii.1967 (*T. G. C.-Gray*), 1 ♂ (both NMR, Bulawayo); N'Gami Country (*F. D. Lugard*), 1 ♂ (BMNH). RHODESIA: Wankie, xii. 1961, 1 ♂, 1 ♀ (NMR, Bulawayo).

*Zamarada torrida* sp. n.

(Text-figs 59, 60; Pl. 14, figs 505, 506; Pl. 98, fig. 874)

[*Zamarada secularia* (Guenée) sensu Fawcett, 1916 : 728. Misidentification.][*Zamarada secularia* (Guenée) sensu Rothschild, 1921 : 217. Misidentification.][*Zamarada secularia* (Guenée) sensu Prout, 1932 : 506 (part). Misidentification.][*Zamarada secularia* (Guenée) sensu Wiltshire, 1947 : 11, pl. fig. 14. Misidentification.][*Zamarada secularia* (Guenée) sensu Wiltshire, 1949 : 425, text-fig. 108. Misidentification.]

♂ ♀ (Pl. 98, fig. 874). Hyaline area of each wing very sparsely irrorate with brownish grey; costa of fore wing irrorate with light yellow, yellowish brown and brownish grey; discal spot on fore wing elongate and silvery grey outlined with dark brown, that on hind wing minute and brown, but often wanting. Proximal eighth and non-hyaline terminal area of each wing brownish grey; postmedial fascia, bounding hyaline area distally, dark brown or black edged distally with silvery grey; subterminal fascia brownish yellow edged distally with light yellow; termen slenderly and brokenly dark brown or black; cilia light yellow, chequered with dark brown. Underside of non-hyaline terminal area brown more or less suffused with greyish brown from mid-wing apicad.

♂ genitalia (Text-figs 59, 60). Uncus tapered. Ventral plate of gnathus tapered to narrowly rounded tip. Dorsal processes of valves asymmetrical, serrate-edged in part, as illustrated (Text-fig. 59). Fulcrum extending beyond aedeagus, the tip slightly spatulate and spined. Apical third of aedeagus slenderly produced and sclerotized with a small scobinate area at two-thirds.

Examples from Aïr and Damergou in N. Niger differ in the more slender dorsal process of the right-hand valve.

♀ genitalia (Pl. 14, figs 505, 506). Posterior third of corpus bursae sclerotized; right-hand margin obtusely angled.

Measurements. Fore wing: ♂ 7.5–10.0 mm; ♀ 8.0–10.5 mm. Antennal pectinations: ♂ 10 ×, ♀ 4 × diameter of shaft.

Distinguished superficially from the rather similar *minimaria* by the more elongate discal spot on the fore wing and by the absence of a yellowish medial fascia from each wing; in the male the presence of a dilate hind tibia with a pencil of long hair-scales distinguishes *torrida*. In the male genitalia the form of the asymmetrical processes on the valves distinguishes *torrida* and *tosta* from related species; the form of the left-hand process in *torrida* is specifically diagnostic. In the female genitalia the pattern of the sclerotization of the corpus bursae is diagnostic.

DISTRIBUTION. Jordan, Israel, Saudi Arabia, Yemen, Egypt, S. Algeria, Niger, S.E. Sudan, Eritrea, Somalia, Ethiopia, E. Kenya, E. Tanzania.

Holotype ♂, ETHIOPIA ('Abyssinia'): Dire Daoua, i. 1935 (*H. Uhlenhuth*), Geometridae genitalia slide no. 1608, in BMNH.

Paratypes. JORDAN: Ghor el Safieh, S. end of Dead Sea, 16–28.iii.1933 (*M. Aigner*), 1 ♀. ISRAEL ('S. Palestine'): Tel Arad, 29.v.1923 (*P. A. Buxton*), 1 ♂. SAUDI ARABIA: Najran, 10–11.vii.1936, 1 ♀; Tarima, 8.xi.1936, 1 ♀ (both *H. St. J. B. Philby*); Abs Tihama, 29.ix.1962 (*G. Popov*), 1 ♀; Jidda, 17.i.1930, 1 ♀; ibidem, 5.iv.1929, 1 ♀; 17.iv.1936, 1 ♀; Taif, 17.v.1934, 1 ♀; ibidem, 16.vi.1934,



1 ♂; 8.ix.1934, 1 ♀; Ukadh, 13.i.1935, 1 ♀; Mecca, 12.iii.1931, 1 ♀; ibidem, 17.iii-17.iv.1934, 2 ♂, 2 ♀; ibidem, 21.v.1931, 1 ♂ (all *H. St. J. B. Philby*); Mahdatha 60 miles N.E. of Mecca, i. 1945 (*Dr B. P. Uvarov*), 1 ♀; Ashayrah (Ashaira), 30.i.1948 (*A. R. Waterston*), 1 ♂; ibidem, 22.ii.1936, 2 ♀; 22.iv.1936, 1 ♀; 5.v.1938, 2 ♂; Sharb Suwaidara, 21.v.1938, 1 ♀ (all *H. St. J. B. Philby*). YEMEN: Near Saada, 27.vii.1962 (*G. Popov*), 2 ♂, 1 ♀; [Wadi] Khabb, 8.x.1936 (*H. St. J. B. Philby*), 2 ♀. EGYPT: Northern Etbai (*D. MacAlister*), 1 ♂ (BMNH); Wüste Etbai, Wadi Sinait (*Fr. Grote*), 1 ♂ (MNHU, Berlin). SUDAN: south-east, Kassala Prov., Erkowit, 1000-1300 m, 18-19.iv.1962 (*R. Remane*), 1 ♂, 2 ♀; ibidem, 19-29.vi.1962, 6 ♂, 3 ♀ (all ZSBS, Munich). ERITREA: Carai, 17-21.xi.1905 (*N. Beccari*), 1 ♂, 1 ♀. SOMALIA: N. Region, 48 miles E.S.E. of Erigavo, x. 1961 (*C. Hemming*), 1 ♂. ETHIOPIA: Dire Daoua, i. 1935 (*H. Uhlenhuth*), 1 ♂, 11 ♀; ibidem, ii. 1935, 7 ♀; iii. 1935, 4 ♂, 9 ♀; iv. 1935, 16 ♂, 15 ♀; v. 1935, 20 ♂, 12 ♀; vi. 1935, 9 ♂, 15 ♀; vii. 1935, 2 ♂; viii. 1935, 2 ♂, 2 ♀; ix. 1935, 1 ♂; xii. 1934, 5 ♀; Maraquo, viii-ix. 1914 (*O. Kovacs*) 1 ♂. KENYA: Ngong, Nairobi, iii-iv. 1954 (*Fowler & Coulson*), 1 ♀; Kajiado, Ologasailie, iv. 1960 (*R. Carcasson*), 1 ♀ (NMK, Nairobi); Kibwezi, i.i.1918 (*W. Feather*), 1 ♂; ibidem, iv. 1922, 1 ♀; 9.v.1919, 1 ♂; v. 1960 (*R. Carcasson*), 1 ♀; xii. 1921 (*Dummer*), 1 ♂, 1 ♀; Kedai, 15.iii.1912 (*W. Feather*), 1 ♀; ibidem, 29.xii.1912, 1 ♀; Mesongaleni, 2.iv.1911 (*W. Feather*), 1 ♂ (all BMNH); Pori, Mbuyuni, 1110 m, iii. 1912 (*Alluaud & Jeannel*), 1 ♀ (MNH, Paris), 1 ♀ (BMNH); Nyali, xii. 1968 (*D. G. Sevastopulo*), 1 ♂, 1 ♀ (BMNH). TANZANIA: Simiya R., Serengeti Plain, 3500 ft, vii. 1952 (*J. G. Williams*), 1 ♀; Olduvai Gorge, iii. 1960 (*J. Leakey*), 1 ♀; Mkalama, 1905 (*Marwitz*), 2 ♂, 4 ♀ (MNHU, Berlin); Dodoma, iii. 1950 (*N. Mitton*), 1 ♂, 1 ♀ (NMK, Nairobi); 50 miles S. of Dodoma, 11-12.iii.1950 (*N. Mitton*), 2 ♂, 6 ♀; 50 miles N. of Iringa, ii-iii. 1950 (*N. Mitton*), 1 ♂, 3 ♀; Iringa, iii. 1950 (*N. Mitton*), 2 ♂ (all TM, Pretoria); Morogoro (*Reuss*), 1 ♀ (MNHU, Berlin).

The isolated populations of Air, Niger Republic and of Ahaggar, S. Algeria are associated with *torrida*, but excluded from the type-series.

NIGER: Damergou, Takoukout, 12-26.iii.1920 (*A. Buchanan*), 1 ♂, 1 ♀ (BMNH); Air (*P. de Miré*), 1 ♂ (coll. Herbulot, Paris). ALGERIA: south, 20 km N. of Ideles, 1200 m, 31.iii.1914 (*G. von Schweppenb.*), 1 ♀ (BMNH).

### *Zamarada tosta* sp. n.

(Text-figs 61, 62; Pl. 14, figs 507, 508; Pl. 98, fig. 875)

♂ ♀ (Pl. 98, fig. 875). Hyaline area of each wing sparsely irrorate with dark brown; costa of fore wing light yellow irrorate with grey; discal spot on fore wing ovate, silvery grey outlined with black. Proximal eighth and non-hyaline terminal area of each wing light grey irrorate with dark brown and black; postmedial fascia, bordering hyaline area distally, black edged distally with silvery grey; subterminal fascia, irregular and broken, brownish yellow edged distally with silvery grey; termen finely and brokenly black; cilia light yellow chequered with light grey. Underside of non-hyaline terminal area greyish yellow irrorate distally and densely suffused proximally, with grey.

♂ genitalia (Text-figs 61, 62). Differ from the closely related *torrida* in the form of the asymmetrical dorsal processes of the valves; the apical fourth of the right-hand process lies

at angle of 60–90 degrees to the serrate medial third in *torrida*, but at a much more acute angle in *tosta*; the serrate edge of the left-hand process, angled in *torrida*, is usually shallowly excavate in *tosta*.

♀ genitalia (Pl. 14, figs 507, 508). Differ from *torrida* in the markedly reduced sclerotization of the corpus bursae, confined in *tosta* to the posterior tenth, and in the absence of the conspicuous obtuse angle at the right side, characteristic of that species.

Measurements. Fore wing: ♂ 10–12 mm; ♀ 11.5–13.0 mm. Antennal pectinations: ♂ 12 ×, ♀ 3–4 × diameter of shaft.

Closely related to, perhaps a subspecies of *torrida*; differing externally in its larger size and darker wing pattern and structurally in the genitalia as noted above.

DISTRIBUTION. South West Africa.

Holotype ♂ SOUTH WEST AFRICA: Rehoboth Distr., 7–17.v.1965 (*J. H. Potgieter*), in TM, Pretoria.

Paratypes. SOUTH WEST AFRICA: Bullspoort, iv. 1949 (*R. G. Strey*), 2 ♀; ibidem, vi. 1949, 1 ♂, vii. 1949, 1 ♂; holotype data, 6 ♂, 15 ♀ (all TM, Pretoria); Okahandja, 3–16.ii.1928 (*R. E. Turner*), 1 ♂, 1 ♀; ibidem, 24.ii–1.iii.1928, 1 ♀; 12–18.xii.1927, 1 ♂; Okahandja, ii. 1935 (*F. Gaerdes*), 1 ♂; Sissekab, N.W. of Otavi, 1300 m, 11.xi.1933 (*Dr K. Jordan*), 1 ♂ (all BMNH); Abachaus [Otjiwarongo Distr.], viii. 1942 (*G. Meyer*), 1 ♀ (TM, Pretoria).

### *Zamarada delta* sp. n.

(Text-figs 63, 64; Pl. 13, figs 503, 504; Pl. 98, fig. 876)

♂ ♀ (Pl. 98, fig. 876). Hyaline area of each wing yellowish white sparsely irrorate with brownish grey; costa of fore wing yellowish white to light yellow, similarly irrorate; medial fascia weakly marked and broken, light yellow; discal spots dark brown, minute. Non-hyaline terminal area of each wing brownish grey (pl. 8, C2) paling to yellowish white terminad; post-medial fascia, forming distal margin of hyaline area, dark brown edged proximally with light yellow and distally with silvery grey; subterminal fascia broken and irregular, brownish yellow (pl. 5, C8). Underside of non-hyaline terminal area greyish yellow to buff varyingly suffused with brownish orange to brown.

♂ genitalia (Text-figs 63, 64). Uncus tapered. Ventral plate of gnathus broadly spatulate. Dorsal process of valve with smooth-edged, triangular projection at one-half. Fulcrum nearly twice as long as aedeagus, slender with finely scobinate tip. Ventral surface of aedeagus sclerotized and tapered and scobinate apicad.

♀ genitalia (Pl. 13, figs. 503, 504). Sterigma asymmetrical, as illustrated.

Measurements. Fore wing: ♂ 10.5–12.5 mm; ♀ 10.5–13.0 mm. Antennal pectinations: ♂ 11 ×, ♀ 9 × diameter of shaft.

Differs from the externally rather similar *chrysothyra* and *erugata* in the brownish grey, almost pinkish grey, colour of the wings and in the minute discal spots. Males differ from *erugata* in the presence of a dilate hind tibia enclosing a pencil of long hair scales and from both *erugata* and *chrysothyra* in the genitalia; distinguished from the rather similar genitalia of *erugata* by the sharply angled apex of the triangular projection from the dorsal process of the valve and by the appreciably

longer fulcrum. The female of *delta* may be distinguished from these two species by the longer antennal pectinations and in the genitalia by the form of the sterigma.

BIOLOGY. A. L. H. Townsend reared larvae on *Acacia* sp. at Nakuru in 1940.

DISTRIBUTION. Ethiopia, Sudan, Kenya, Tanzania, Uganda, Burundi, Rwanda, E. Zaire.

Holotype ♂, KENYA: S. Kavirondo, Suna, xii. 1931 (*W. Feather*), Geometridae genitalia slide no. 1667, in BMNH.

Paratypes. ETHIOPIA: Gondar Road, 10 miles N. of Lake Tana, 6000 ft, 15.x.1926 (*R. E. Cheeseman*), 1 ♀. SUDAN: Tambora, southern Bahr-el-Ghazal, 1 ♂; Lado Enclave, Kajomba, vii. 1912, 1 ♂; Lado Enclave, Alenina, 21.viii.1912, 1 ♂; Mongalla, Imatong Mts, 4°12' N. 32°35' E., Imilla (*A. L. Kent-Lemon*), 1 ♂ (UM, Oxford). KENYA: Ruiru, Jacaranda Research Station, iv. 1960, 1 ♂; ibidem, iv. 1961, 1 ♂ (both BMNH); ibidem, x. 1964, 1 ♀ (NMK, Nairobi); Nairobi (*van Someren*), 1 ♀; ibidem, v. 1919, 1 ♂; ibidem (*F. J. Jackson*), 1 ♂; Nairobi, Ngong, v. 1956 (*R. Coulson*), 1 ♀; Hoey's Bridge (5 mile radius), iv-v, 1930 (*E. Barns*), 1 ♂; Nakuru, 10.i.1950 (*A. Townsend*), 1 ♂; ibidem, 19.i.1946, 1 ♂; 7.vi.1947, 1 ♂; 20.ix.1940, bred, *Acacia*, 1 ♂ (all BMNH); ibidem, 21.xi.1951, 1 ♀; 3.xii.1951, 1 ♀ (both NMK, Nairobi); Kitale (*G. W. Jeffery*), 1 ♂; ibidem, 19.vii.1925, 1 ♂; 5.xii.1925, 1 ♂; Kitale, iv. 1958 (*R. Leaky*), 1 ♂; Kitale, v-vi. 1962 (*Mrs E. M. Dougall*), 1 ♂ (NMK, Nairobi); Kitale, viii. 1953 (*C. R. Howard*), 1 ♂ (NMK, Nairobi); Mt Elgon, xi. 1931 (*T. H. E. Jackson*), 1 ♂; Cherangani Hills, E. of Mt Elgon, 6200 ft, x. 1924 (*C. R. S. Pitman*), 1 ♂; S. Kavirondo, vi. 1930 (*W. Feather*), 1 ♀; ibidem, xi. 1931, 1 ♀. TANZANIA: Maboia (Maboia) (*Dr Baxter*), 1 ♀; Morogoro, 1931-32 (*J. A. J. Thompson*), 1 ♂ (both BMNH); Mt Meru, Momella, 1600-1800 m, 11-20.i.1964 (*W. Forster*), 1 ♂; Kigonsera, 20.i.1960 (*Pater O. Morger*), 1 ♂ (both ZSBS, Munich). UGANDA: Unyoro, Labonga 6.vii.1897 (*Dr Ansorge*), 1 ♂; Unyoro, Bulluji, 7.vii.1897 (*Dr Ansorge*), 1 ♂; Masindi, vi. 1897 (*Dr Ansorge*), 1 ♂; Mpanga Forest, Fort Portal, v. 1958 (*R. Carcasson*), 1 ♂; Toro, Kibale Forest, v. 1966 (*R. Carcasson*), 1 ♀ (NMK, Nairobi); Kampala, 7.ix.1949 (*D. G. Sevastopulo*), 1 ♂; Ketoma, iv. 1903 (*W. L. Doggett*), 2 ♂; Mulema, v. 1903 (*W. L. Doggett*), 1 ♂. BURUNDI: Usumbura, iii. 1934 (*Lefèvre*) 1 ♂ (MRAC, Tervuren). RWANDA: Gabiro, 1933, 1 ♂ (MRAC, Tervuren). ZAIRE (Belgian Congo): Kivu, Rutchuru, iv. 1924 (*T. A. Barns*), 1 ♀; Upper Uele Dist., Dungu, vii, 1 ♂; Kilo 343 de Kindu, nuit (*Dr Russo*), 1 ♂ (all BMNH); Kibali-Ituri, Geti (*Ch. Scops*), 1 ♂; Lulua, Kapanga, xii. 1933 (*Overlaert*), 1 ♂ (both MRAC, Tervuren).

### *Zamarada psammites* Fletcher

(Text-figs 65, 66; Pl. 15, figs 511, 512; Pl. 98, figs 877, 878)

*Zamarada psammites* Fletcher, 1958a : 141, pl. 2, figs 9, 11; pl. 5, figs 31, 33, 35. Holotype ♀, KENYA (BMNH) [examined].

♂ ♀ (Pl. 98, figs 877, 878). Hyaline area of wings irrorate with corn colour, fore wing moderately, hind wing sparsely; broad, straight, but ill-defined brownish yellow medial fascia and slender, dark brown postmedial fascia bordering hyaline area distally, developed in some examples; discal spots black, those on hind wing minute; terminal interneural spots black.



Costa of fore wing and non-hyaline terminal area of each wing corn colour (pl. 4, B5), some examples a tone paler, a few examples much darker, sparsely striate with brownish yellow; black irroration occasionally present between veins  $M_1$  and  $M_3$ . Underside of non-hyaline terminal area very weakly orange white, a little darker in apical area of fore wing. Specimens darkly marked on upperside are correspondingly marked in grey on the underside.

♂ genitalia (Text-figs 65, 66). Uncus short and tapered. Ventral plate of gnathus slender, tip narrowly rounded. Dorsal process of valve with triangular projection, weakly serrate along posterior margin. Apical half of aedeagus coarsely spined at one side, the spines equal to or longer than cornutus. Fulcrum one and one-half times as long as aedeagus, apex minutely scobinate.

♀ genitalia (Pl. 15, figs 511, 512). Sterigma slightly asymmetrical, as illustrated.

Measurements. Fore wing: ♂ 11.5–12.0 mm; ♀ 10.5–12.0 mm. Antennal pectinations: ♂ 13 ×, ♀ 2 × diameter of shaft.

Distinguished from the externally similar *hyalinaria* Guenée and *ochrata* Warren by the shallower intrusion of the hyaline area of each wing into the coloured terminal third, between veins  $M_3$  and  $Cu_{1b}$  and by the absence in most examples of a post-medial fascia bounding the hyaline area distally; distinguished further from *ochrata* by the absence of dark markings on the underside of the wings. Distinguished from the structurally similar *erugata* and *delta* by the less strongly sclerotized and serrate-edged triangular projection from the dorsal process on the valve and by the more coarsely and longer spined apical half of the aedeagus. In the female genitalia the form of the asymmetrical sterigma is diagnostic.

DISTRIBUTION. W. Kenya, S.E. Zaire, Tanzania, E. Rhodesia, Mozambique.

#### MATERIAL EXAMINED.

*Zamarada psammites* Fletcher, holotype ♀ [not ♂ as stated in original description], KENYA: Mt Elgon, iii. 1953 (*T. H. E. Jackson*), Geometridae genitalia slide no. 6846, in BMNH.

KENYA: Mt Elgon, iv–vi, ix–xii (*T. H. E. Jackson*), 7 ♂, 7 ♀; ibidem, x. 1950 (*E. Pinhey*) 1 ♂ (paratypes of *Zamarada psammites*); Kitale, xii. 1961 (*Mrs E. M. Dougall*), 1 ♂ (NMK, Nairobi); Kakamega, xi. 1964 (*R. Carcasson*), 2 ♂ (NMK, Nairobi); Malaba Forest, vi. 1957 (*C. R. Howard*), 1 ♂ (BMNH). ZAIRE (Belgian Congo): Marangu Plateau, 7000 ft, ii. 1932 (*T. A. Barns*) 1 ♂, 2 ♀ (paratypes of *Zamarada psammites*; labelled 'S.W. Tanganyika', recte 'S.W. Lake Tanganyika'). RHODESIA: Vumba Mts, Umtali, ii, 2 ♂, 3 ♀ (NMR, Bulawayo); Vumba, Laurenceville, 6–12.ii.1964 (*Vári & van Son*), 1 ♀; Mt Selinda, 9–17.iv.1956 (*van Son & Vári*), 1 ♂ (both TM, Pretoria). MOZAMBIQUE: Vila Machado Distr., Xiluvo, 19.x.1963 (*D. M. Cookson*), 1 ♀ (TM, Pretoria).

#### *Zamarada hyalinaria* (Guenée)

(Text-figs 67, 68; Pl. 15, figs 509, 510; Pl. 99, figs 879, 880)

*Stegania hyalinaria* Guenée, 1857a : 45. Holotype ♀, ETHIOPIA (MNHN, Paris) [examined].

♂ ♀ (Pl. 99, figs 879, 880). Hyaline proximal three-fourths of each wing yellowish white; terminal fourth greyish orange distad of smoothly sinuous yellowish white subterminal fascia,



brownish orange proximad of it, especially at costa and posterior margin of fore wing; terminal fourth of fore wing irrorate with black between veins  $M_1$  and  $M_3$ ; broad, straight, antemedial and medial and slender postmedial fasciae brownish orange marked on fore wing in some examples; discal spots black, that on hind wing minute. Underside of non-hyaline terminal area straw yellow sparsely irrorate with brownish orange; dark markings of upperside represented on underside by brown suffusion.

♂ genitalia (Text-figs 67, 68). Tip of uncus broadly rounded, almost truncate. Ventral plate of gnathus broadly rounded. Dorsal process of valve cygnate, broadened at two-thirds, then tapered. Apical fifth of dorsal surface of aedeagus scobinate. Fulcrum slender, tip minutely spined.

♀ genitalia (Pl. 15, figs 509, 510). Sterigma asymmetrical. Posterior fourth of corpus bursae sclerotized.

Measurements. Fore wing: ♂ ♀ 11–13 mm. Antennal pectinations: ♂ 15 ×, ♀ 2.5 × diameter of shaft.

Distinguished externally from *psammites* and *ochrata* by the presence of a smoothly sinuous subterminal fascia and of the orange-brown area proximad of it; further distinguished from *ochrata* by the reduction of dark marking on the underside of the wings. Distinguished structurally from *ochrata* by the longer, almost truncate uncus, the broader ventral plate of the gnathus and the form of the dorsal process of the valve. In the female genitalia the form of the sterigma and of the sclerotized posterior fourth of the corpus bursae are diagnostic.

DISTRIBUTION. Ethiopia, Kenya.

#### MATERIAL EXAMINED.

*Stegania hyalinaria* Guenée, holotype ♀, ETHIOPIA ('Abyssinie'), 1850 (*Schimper*), in MNHN, Paris.

ETHIOPIA: C. Abyssinia, Hoache (?Awash, 9°0' N. 40°10' E.), 5.x.1914 (*O. Kovacs*), 1 ♀; Dangila, 40 miles S. of Lake Tana, 6700 ft, 25.xii.1926 (*R. E. Cheeseman*), 1 ♂ (all BMNH); Nolé Kaba [8°75' N. 35°75' E.], 2.v.1926, 1 ♀; Giam Giam (Djemdjem), 22.vi.1925, 1 ♂; Youbdo, Birbir River (Ioubdo, Birbir) [8°90' N. 35°45' E.], 5.i.1927, 1 ♀; ibidem, 6.xi.1926, 1 ♀ (all MNHN, Paris); Kaffa, Gembi [8°0' N. 36°60' E.], 1550 m, xi. 1957 (*F. Schäuffele*), 2 ♂, 1 ♀ (SMN, Stuttgart). KENYA: Kitale, viii. 1953 (*C. R. Howard*), 1 ♀ (NMK, Nairobi); Mt Elgon, i–iv, vii–xii (*T. H. E. Jackson*), 3 ♂, 9 ♀ (BMNH), 3 ♀ (NMK, Nairobi); Mt Elgon, versant est, Suam Fishing Hut, 2400 m, 1 ♂; Mt Elgon, versant est, Elgon Saw Mill, 2470 m, 2 ♂, 1 ♀ (all MNHN, Paris).

### *Zamarada ochrata* Warren

(Text-figs 69, 70; Pl. 16, figs 513, 514; Pl. 99, figs 881–884)

*Zamarada ochrata* Warren, 1902a : 518. Holotype ♂, KENYA (BMNH) [examined].

*Zamarada ochrata* Warren; Townsend, 1937 : 128, biology.

♂ ♀ (Pl. 99, figs 881–884). Hyaline area of wings light yellow irrorate with a darker shade, moderately on fore wing, sparsely on hind wing, the hyaline intruding strongly into the non-hyaline terminal area between veins  $M_3$  and  $Cu_{1b}$ ; discal spot light yellow ringed with dark brown on fore wing, that on hind wing dark brown to black, minute. Brown irroration in

hyaline area of fore wing concentrated in some examples to form a broad medial fascia. Non-hyaline terminal area a shade darker than that of hyaline area (pl. 3, A<sub>4</sub>), irrorate with light brown, especially proximad of the dentate, white subterminal fascia. Underside of non-hyaline terminal area very weakly orange-white; a short, broad, greyish brown fascia proximally on fore wing from costa to vein  $M_3$ ; a similarly coloured and placed fascia sometimes present on hind wing.

♂ genitalia (Text-figs 69, 70). Uncus short and tapered. Ventral plate of gnathus as long as uncus, the apex narrowly rounded. Dorsal process of valve cygnate and slightly dilate at two-thirds, posterior surface slightly crenulate and setose apicad. Aedeagus smooth. Fulcrum slender, apex minutely spined.

♀ genitalia (Pl. 16, figs 513, 514). Sterigma with lateral margins strongly crenulate.

Measurements. Fore wing: ♂ 9.5–12.5 mm; ♀ 11–14 mm. Antennal pectinations: ♂ 12 ×, ♀ 2.5 × diameter of shaft.

Distinguished externally from *psammites* by the deeper intrusion of the hyaline area of each wing into the patterned distal fourth between veins  $M_3$  and  $Cu_{1b}$  and from both *psammites* and *hyalinaria* by the usually well marked, white subterminal fascia and the dark-patterned underside of the wings. In the male genitalia *ochrata* may be distinguished from the closely similar *hyalinaria* by the form of the dorsal process of the valve, the narrowly rounded tip of the ventral plate of the gnathus and the smooth, unspined aedeagus. In the female genitalia the form of the sterigma is diagnostic.

BIOLOGY. A. L. H. Townsend bred *ochrata* at Nakuru, rearing the larvae on *Acacia* sp., and published descriptions of the eggs, larvae and pupae (1937: 128–129).

DISTRIBUTION. Kenya, Tanzania.

#### MATERIAL EXAMINED.

*Zamarada ochrata* Warren, holotype ♂, KENYA (B.E.A. [British East Africa]): Escarpment, 6500–9000 ft, iii. 1901 (*W. Doherty*), Geometridae genitalia slide no. 1699, in BMNH.

KENYA: Mombasa (*van Someren*), 1 ♂; Kibwezi, 18.xii.1916–14.i.1917 (*W. Feather*) 2 ♂, 1 ♀; Nairobi, iv, xi, 3 ♂, 1 ♀ (NMK, Nairobi); holotype data, xii. 1900–i. 1901, 2 ♂ Naivasha, 6–10.v.1942 (*H. Copley*), 4 ♂, 2 ♀ (BMNH); ibidem, 1900 m, 1 ♂ (MNHN, Paris); Nakuru, 8.vi.1927 (*D. M. Hopkins*), 1 ♂; Nakuru, bred, ii, iii, viii, x–xii (*A. Townsend*), 4 ♂, 8 ♀ (BMNH), 4 ♂, 4 ♀ (NMK, Nairobi). TANZANIA: Mombo, 2 ♀ (MNHU, Berlin); Mt Meru, Momella, 1800 m, x. 1958 (*C. Lindemann*), 1 ♀; ibidem, x–xi, 1957 (*H. Engel*), 1 ♀; ibidem, 11.i–19.ii.1964 (*W. Forster*), 10 ♂, 13 ♀ (all ZSBS, Munich); Mbeya, 28.xi.1950 (*H. B. Kettlewell*), 3 ♂, 1 ♀ (BMNH).

#### *Zamarada melasma* sp. n.

(Text-figs 71, 72; Pl. 16, figs 515, 516; Pl. 99, figs 885, 886)

[*Zamarada secutaria* (Guenée) sensu Prout, 1932 : 506 (part). Misidentification.]

♂ ♀ (Pl. 99, figs 885, 886). Hyaline area of fore wing irrorate with brown and grey, the irroration concentrated in some examples to form a broad medial fascia; hyaline area intruding strongly into patterned terminal third between veins  $M_3$  and  $Cu_{1b}$  on fore wing, but to an

appreciably lesser degree on hind wing in most examples; discal spot on fore wing silvery grey outlined with black, that on hind wing minute and black, when present. Basal area and costa of fore wing and non-hyaline terminal area of each wing greyish orange (pl. 5, B4-B6) varyingly irrorate with sepia to black, usually densely in apical half of hind wing, where it forms a conspicuous dark clouding, and to a lesser extent in the discal and tornal areas of the fore wing; slender sepia postmedial fascia, bordering the hyaline area distally, edged distally with silvery grey; subterminal fascia silvery grey, the area between the two fasciae suffused with orange-brown on the fore wing and on the posterior half of the hind wing. Underside of non-hyaline terminal area greyish brown; in some examples the fore wing is brown in the tornal area.

♂ genitalia (Text-figs 71, 72). Uncus stout and tapered. Ventral plate of gnathus dilate and disc-like. Dorsal process of valve with spatulate, digitate projection. Aedeagus with short, coarse spines at apex. Fulcrum three-eighths as long as aedeagus, simple and tapered to a point.

♀ genitalia (Pl. 16, figs 515, 516). Sterigma symmetrical; lamella postvaginalis bifurcate.

Measurements. Fore wing: ♂ 8-10 mm; ♀ 8.5-10.0 mm. Antennal pectinations: ♂ 10 ×, ♀ 2.5 × diameter of shaft.

Distinguished externally in most examples by the pronounced dark clouding of the apical half of the distal third of the hind wing. Distinguished structurally from the closely related *ilma* Prout by the form of the uncus, ventral plate of the gnathus and the fulcrum and in the female genitalia by the form of the sterigma.

DISTRIBUTION. Ethiopia, Sudan, Kenya, Tanzania.

Holotype ♂, ETHIOPIA ('Abyssinia'): Dire Daoua, iv. 1936 (*H. Uhlenhuth*), Geometridae genitalia slide no. 1618, in BMNH.

Paratypes. ETHIOPIA: Dire Daoua, i. 1935 (*H. Uhlenhuth*), 4 ♀; ibidem, ii. 1935, 1 ♂, 5 ♀; iii. 1935, 5 ♀; iv. 1935, 4 ♂, 10 ♀; v. 1935, 2 ♂, 15 ♀; vi. 1935, 1 ♂, 14 ♀; xii. 1935, 2 ♀; Diredaoua, N.W. of Harar, 1914 (*G. Kristensen*), 1 ♂ (all BMNH); Awash (Aouash), 960 m, viii. 1957 (*Fr. Schäuffele*), 2 ♀ (SMN, Stuttgart). KENYA: N. F. D., Mandera, Malka Murri, vi-vii. 1951 (*J. G. Williams*), 1 ♀; Mandera, x. 1951, 1 ♀; Marigat, 4000 ft, iii. 1950 (*R. T. Evans*), 1 ♀; ibidem, vii. 1950, 1 ♀; Marsabit, ii. 1956 (*J. G. Williams*), 1 ♂ (all NMK, Nairobi); Kajiado, Ologasailie, iv. 1960 (*R. Carcasson*), 1 ♀; Kibwezi, 23.xii.1918 (*W. Feather*), 1 ♀; ibidem, xii. 1921, (*Dummer*), 2 ♀ (all BMNH); Voi, i. 1967 (*R. Carcasson*), 1 ♂, 1 ♀ (NMK, Nairobi); Pori, Landjoro, 900 m, iii. 1912 (*Alluaud & Jeannel*), 1 ♀ (BMNH). TANZANIA: Serengeti Pl., Simiya R., 3500 ft, vii. 1952 (*J. G. Williams*), 1 ♀; Musoma, Banagi Hill (*Capt. M. S. Moore*), 1 ♂, 2 ♀ (all BMNH); Shinyanga, Mwandui, ii. 1952 (*Capt. Croft*), 1 ♀ (NMK, Nairobi); Olduvai Gorge, iii. 1960 (*J. Leaky*), 1 ♂ (BMNH); ibidem, xi. 1960, 1 ♀ (BMNH), 1 ♀ (NMK, Nairobi); Kilimandjaro, Marangu, 1500 m, 30.x.1958 (*C. Lindemann*), 1 ♀ (ZSBS, Munich); E. Usambara Mts, Amani, ii. 1953 (*E. Pinhey*), 1 ♀ (NMK, Nairobi).

### *Zamarada ilma* Prout

(Text-figs 73, 74; Pl. 17, figs 517, 518; Pl. 99, figs 887, 888)

*Zamarada ilma* Prout, 1922 : 179, pl. 1, fig. 6. Holotype ♂, MOZAMBIQUE (TM, Pretoria) [examined].

*Zamarada opposita* Prout, 1922 : 180, pl. 1, fig. 23. Holotype ♂, TRANSVAAL (TM, Pretoria) [examined]. **Syn. n.**

*Zamarada ilma* Prout; Janse, 1932 : 141, pl. 2, fig. 14.

*Zamarada opposita* Prout; Janse, 1932 : 141, pl. 1, fig. 28.

[*Zamarada metallicata* Warren sensu Prout, 1935 : 13. Misidentification.]

♂♀ (Pl. 99, figs 887, 888). Hyaline area of wings varyingly irrorate with grey; discal spots slender, smoke-brown, that of fore wing silvery grey in middle. Proximal fourth and costa of fore wing and non-hyaline terminal third of each wing greyish yellow (pl. 4, B<sub>3</sub>) irrorate with smoke-brown to black; dark irroration in terminal third of fore wing often dense anterior of vein *M*<sub>3</sub> and posterior of vein *Cu*<sub>1b</sub>; slender, broken postmedial fascia, forming distal margin of hyaline area, edged distally with silvery grey. Underside of non-hyaline terminal area greyish orange (pl. 5, B<sub>3</sub>) suffused with brown in apical area of each wing; in some examples the underside of the non-hyaline terminal area is uniformly greyish brown.

♂ genitalia (Text-figs 73, 74). Uncus very broad, tapered tip minute. Ventral plate of gnathus narrowly rounded at apex. Dorsal process of valve with broad, spatulate projection from one-half. Aedeagus shortly, but coarsely spined near apex. Fulcrum one-half as long as aedeagus, apex broad, hammer-headed and coarsely scobinate.

♀ genitalia (Pl. 17, figs 517, 518). Sterigma symmetrical. Posterior margin of lamella postvaginalis crenulate. Lamella antevaginalis minutely scobinate anteriorly.

Measurements. Fore wing: ♂ 8.5–10.0 mm; ♀ 9.0–10.5 mm. Antennal pectinations: ♂ 12 ×, ♀ 3 × diameter of shaft.

Externally similar to *phaeozona* and to smaller examples of *pulverosa* and *tosta*. The males may be distinguished from *phaeozona* by the presence of a dilate hind tibia with its pencil of long hair-scales; females may be distinguished from *pulverosa* by the shorter antennal pectinations. Structurally the broad uncus and the form of the fulcrum in the male genitalia and the form of the sterigma in the female genitalia are diagnostic.

Examination of the type-specimens of *ilma* and *opposita* and comparison of their genitalia with those of known pairs has confirmed their synonymy, which Prout suspected when he described *opposita*.

**DISTRIBUTION.** Mozambique, Rhodesia, Transvaal, Natal, Botswana, South West Africa.

#### MATERIAL EXAMINED.

*Zamarada ilma* Prout, holotype ♂, MOZAMBIQUE: Magude, xi. 1918 (*C. J. Swierstra*), genitalia slide no. G9147, type no. 2915, in TM, Pretoria. *Zamarada opposita* Prout, holotype ♂, TRANSVAAL: Woodbush Village, iv. 1915 (*C. J. Swierstra*), type no. 2406, without abdomen, in TM, Pretoria. *Zamarada opposita* Prout, paratype ♀, TRANSVAAL: Pretoria, 13.ii.1916 (*A. J. T. Janse*), genitalia slide no. G.9145, type no. 2223, in TM, Pretoria.

**RHODESIA:** Victoria Falls, Big Tree, 6.v.1954 (*A. J. T. Janse*), 1 ♂; Wankie, 15 miles S., 30.iv.1954, 1 ♂ (both TM, Pretoria); 96 miles S.E. of Nuanetsi, 21°55' S. 31°30' E., iv. 1961, 3 ♂, 2 ♀ (NMR, Bulawayo); Van Niekerk Hotel, near Gwaai Bridge, 28–29.iv.1954 (*A. J. T. Janse*), 1 ♀ (TM, Pretoria); Devuli River, Sabi Valley, i. 1966, 1 ♂ (NMR, Bulawayo). **TRANSVAAL:** Kruger National Park Survey, Pafuri, 1.xii.1964 (*Vári & Potgieter*), 5 ♂, 4 ♀; K.N.P., Ledaba Camp, 28.iii.1952



(*Janse & Vári*), 1 ♀; ibidem, 14-18.xi.1961 (*Vári & Rorke*), 1 ♀; ibidem, 7-8.xii.1968 (*L. Vári*), 1 ♀; K.N.P., Nwanedzi, 30.iv-1.v.1968 (*Potgieter & Goode*), 3 ♀; K.N.P., Skukuza, 26-28.iii.1954 (*Potgieter & Goode*), 2 ♂, Messina, 25-28.iii.1954 (*A. J. T. Janse*), 2 ♀; Wylies Poort, 5 miles N., 21-22.iii.1954 (*A. J. T. Janse*), 1 ♀; Shingwedzi, 29.iv.1968 (*Janse & Vári*), 1 ♀; Blouberg, N. side Glenferness, 16-21.i.1955, Transv. Mus. Exped., 5 ♂, 5 ♀; Nylstroom, ii-iii. 1963 (*D. W. Rorke*), 1 ♂; Hectorspruit, 4.iv-15.v.1965 (*Mrs C. Granville*), 1 ♂; Rustenburg, 1-2.xii.1957 (*D. W. Rorke*), 1 ♀; ibidem, i. 1958, 1 ♂; Pretoria, 2.ii.1951 (*L. Vári*), 1 ♀; ibidem, 2.i.1968, 1 ♀ (all TM, Pretoria); Pretoria North, 16.ii.1917 (*C. J. Swierstra*), 1 ♀ (BMNH); ibidem, 21.xii.1957 (*L. Vári*), 1 ♀ (TM, Pretoria). NATAL: Weenen, i-iii, x-xii, 1 ♂, 3 ♀ (BMNH), 3 ♀ (TM, Pretoria); Balgown, Yellow Woods, ii-iii. 1964 (*K. M. Pennington*), 1 ♂ (TM, Pretoria). BOTSWANA: Maun, 18.v.-7.vi.1930, Vernay-Lang Kalahari Exped., 1 ♀ (BMNH); 8 miles N. of Maun, 8-9.ii.1967 (*E. Pinhey*), 4 ♂, 1 ♀; Lake Ngami, Sehitwa, 10.ii.1967 (*E. Pinhey*), 1 ♀; Sepopa, 14.ii.1967 (*E. Pinhey*). 2 ♂ (all NMR, Bulawayo); Bakgatla, Sebele, vii. 1968, 2 ♂, 2 ♀ (BMNH). SOUTH WEST AFRICA: Okahandja, 20.i-16.ii.1928 (*R. E. Turner*), 2 ♂, 2 ♀; ibidem, i. 1935 (*F. Gaerdes*), 1 ♀ (all BMNH); Windhoek, 30.xii.1950 (*H. Kinges*), 1 ♂; ibidem, 7.i.1951, 1 ♀ (both TM, Pretoria).

### THE *DIFFERENS*-GROUP

The two species included in the group are small, with a wing length of 10.0-13.5 mm, predominantly yellowish grey to orange-brown in colour with a smooth proximal margin to the non-hyaline terminal area of each wing, with little or no intrusion by the hyaline area between veins  $M_3$  and  $Cu_{1b}$ .

The male genitalia are characterized by the form of the aedeagus, which bears two apical processes, by the form of the fulcrum, consisting of a membranous fold with a slender, longitudinal, sclerotized mid-rib and by the form of the dorsal process of the valve, which is scobinate for its entire length with a projection at about one-third, but none at base.

In the female genitalia the sterigma is well developed; the corpus bursae is either wholly membranous or partially sclerotized posteriorly; a stellate signum is present.

### KEY TO SPECIES

- 1 Uncus of even width, apex broadly rounded. Dorsal process of valve with slender, tapered projection at two-thirds . . . . . *differens* (p. 62)
- Uncus finely tapered. Dorsal process of valve halberd-shaped with scobinate-edged blade-like projection between one-half and three-fourths . . . . . *jansei* (p. 64)

### *Zamarada differens* Bastelberger

(Text-figs 75, 76; Pl. 17, figs 519 520; Pl. 99, fig. 889)

*Zamarada differens* Bastelberger, 1907 : 167. Holotype ♀, MOZAMBIQUE (NMS, Frankfurt) [examined].

*Zamarada pandatilinea* Prout, 1916: 173, pl. 25, fig. 30. Holotype ♂, TRANSVAAL (TM, Pretoria) [examined].

*Zamarada differens* Bastelberger; Janse, 1932: 141 (part), pl. 1, fig 32, *nec* text-fig. 39.

♂ ♀ (Pl. 99, fig. 889). Base and costa of fore wing and non-hyaline terminal third of each wing corn-colour (pl. 4, B5) varyingly irrorate with black; non-hyaline terminal area not intruded by hyaline area, which is irrorate with black, densely at posterior margin of fore wing, sparsely elsewhere.

♂ genitalia (Text-figs 75, 76). Uncus of even width to broadly rounded apex, which has a minute, beak-like tip medially. Ventral plate of gnathus very weakly sclerotized, lateral arms each with small, lobate projection near base. Dorsal process of valve scobinate and finely tapered with a slender, tapered projection at two-thirds. Aedeagus with two apical processes, the longer one strap-like, the shorter serrate-tipped. Vesica without cornuti.

♀ genitalia (Pl. 17, figs 519, 520). Corpus bursae wholly membranous.

Measurements. Fore wing: ♂ 10-12 mm; ♀ 10.5-13.0 mm. Antennal pectinations: ♂ 11 ×, ♀ 5 × diameter of shaft.

Distinguished externally from similarly coloured, small species in the *minimaria*- and *pulverosa*-groups by the smooth proximal margin of the corn-coloured non-hyaline terminal area of each wing. In the male genitalia the form of the uncus and of the dorsal process of the valve and in the female the form of the sterigma are diagnostic.

DISTRIBUTION. Central African Republic, Uganda, Kenya, Tanzania, Zambia, Rhodesia, Mozambique, Transvaal, Natal, Comoro Is.

#### MATERIAL EXAMINED.

*Zamarada differens* Bastelberger, holotype ♀, MOZAMBIQUE ('Ost Africa'): Ilo, type no. 2678, in NMS, Frankfurt. *Zamarada pandatilinea* Prout, holotype ♂, TRANSVAAL: Three Sisters, 19.iii.1911 (*A. J. T. Janse*), genitalia slide no. 9144, in TM, Pretoria.

CENTRAL AFRICAN REPUBLIC: Bangui, 1 ♂. UGANDA: Bwamba Pass (West side) 5500-7500 ft, xii. 1934-i. 1935 (*F. W. Edwards*), 1 ♂ (BMNH); Bwamba, ii-iii. 1957 (*R. Carcasson*), 2 ♂ (BMNH), 2 ♂ (NMK, Nairobi); ibidem, iii. 1958, 1 ♂ (BMNH). KENYA: Sokoke Forest, 8 miles S. of Malindi, *Brachystegia*, iv. 1969 (*M. Clifton*), 1 ♀ (NMK, Nairobi). TANZANIA: Kilosa, 14.xii.1935, at light (*N. C. E. Miller*), 1 ♂; Old Shinyanga, v. 1954 (*E. Burtl*), 2 ♀ (all BMNH). ZAMBIA: Lusaka, 18.ii.1962, 1 ♂ (NMR, Bulawayo); Ndola, 10.i.1965, 1 ♀ (BMNH). RHODESIA: Salisbury, 16.v.1960 (*A. J. Duke*), 1 ♂ (NMR, Bulawayo). TRANSVAAL: Kruger National Park Survey, Skukuza, 25-28.iv.1968 (*Potgieter & Goode*), 2 ♂, 3 ♀; Matjulwana, 5.xii.1963 (*L. Vári*), 1 ♀; Pretoriuskop, 1.iv.1952 (*L. Vári*), 1 ♂ (all TM, Pretoria); Singerton, vi.1910 (*Munro*), 1 ♀ (*Zamarada pandatilinea*, paratype); Marobani Mts, Drakensberg Range, 1000 m (*H. Junod*), 1 ♀; Pretoria, 27.i.1915 (*A. J. T. Janse*), 1 ♂; ibidem, 5.iii.1915, 1 ♂ (all BMNH); ibidem, 18.iii.1915, 1 ♀ (TM, Pretoria). NATAL: Mtuzini Distr., Ngoya Forest, 19-21.iii.1968 (*Potgieter & Goode*), 1 ♀; Ingwavuma, 6-9.ii.1968 (*Potgieter & Jones*), 1 ♀ (both TM, Pretoria). COMORO Is.: Anjouan I., 13.vii.1911 (*G. F. Leigh*), 1 ♀ (BMNH).

*Zamarada jansei* sp. n.

(Text-figs 77, 78,; Pl. 18, figs 521, 522; Pl. 99, fig. 890)

[*Zamarada differens* Bastelberger sensu Janse, 1932 : 141 (part), text-fig. 39. Misidentification.]

♂ ♀ (Pl. 99, fig. 890). Costa of fore wing yellowish brown to brownish orange, irrorate with black; posterior margin of fore wing and non-hyaline terminal third of each wing light brown (pl. 5, D6) irrorate with black; densely in subterminal area; ante- and postmedial fasciae slender and black; discal spots black; hyaline area, intruding very slightly into patterned distal third between veins  $M_3$  and  $Cu_{1b}$ , irrorate with black or with light brown and black.

♂ genitalia (Text-figs 77, 78). Uncus tapered. Ventral plate of gnathus not developed. Dorsal process of valve halberd-shaped with a scobinate-edged, blade-like projection between one-half and three-fourths. Aedeagus with two tapered, apical processes, the longer one scobinate. Vesica with a cluster of short spines.

♀ genitalia (Pl. 18, figs 521, 522). Posterior third of corpus bursae ribbed and sclerotized. Signum stellate.

Measurements. Fore wing: ♂ 12 mm; ♀ 13 mm. Antennal pectinations: ♂ 12 ×, ♀ 4 × diameter of shaft.

Differs externally from *differens* in the darker, black irroration of both hyaline and non-hyaline areas of the wings and in the usually better developed black antemedial fascia, which extends to the costa on the fore wing. In the male genitalia the tapered uncus, the halberd-shaped dorsal process of the valve and the presence of cornuti on the vesica and in the female genitalia the sclerotization and ribbing of the posterior third of the corpus bursae are diagnostic.

DISTRIBUTION. Rhodesia.

Holotype ♂, RHODESIA: Nyamandlovu, iv. 1960, in NMR, Bulawayo.

Paratypes. RHODESIA: Marandellas, i. 1962, 1 ♂ (NMR, Bulawayo); Msali Bridge, 17-19.iv.1954 (*A. J. T. Janse*), 1 ♀; Hopefontain, 16-17.i.1918 (*A. J. T. Janse*), 2 ♂ (all TM, Pretoria).

THE *SCRIPTIFASCIATA*-GROUP

All the species in the group are Oriental in distribution. The hyaline area of the wings is greyish yellow with little or no dark irroration; the non-hyaline terminal area is predominantly brown or greyish brown; the fore wing measures 13-18 mm. The group is characterized in the male genitalia by the cowl-like uncus, which has a minute, tapered projection from the mid-apical margin, a slender dorsal ridge and long setae on the dorsal surface basad. The ventral plate of the gnathus is usually tapered to a narrowly rounded tip. The aedeagus has one or two longitudinal, scobinate ridges. The fulcrum is reduced, slender and weakly sclerotized. Vesica with a stout cornutus. The female genitalia have three processes extending posteriorly from the sterigma, a medial process from the lamella postvaginalis and two lateral processes, serrate at apices, from the lamella antevaginalis.

## KEY TO SPECIES

- 1 Distributed in Tanimbar Islands. . . . . *fugax* (p. 67)  
(Species known from only unique female holotype).

- Distributed elsewhere in Oriental region . . . . . 2
- 2 (1) Valve narrowed evenly apicad, apex spatulate or tapered; if tapered, then finely so with apical fourth incurved towards uncus and that part of ventral margin serrate; dorsal process of valve with setose dilation or projection at one-third . . . . . 3
- Valve narrowed abruptly in apical third or fourth; dorsal margin angled through 90 degrees; apex of valve smoothly tapered and inclined towards uncus; dorsal process without setose dilation or projection at one-third. . . . . 4
- 3 (2) Apex of valve spatulate and narrowly rounded; dorsal process dilate and setose at one-third. Ventral plate of gnathus truncate. Aedeagus with coarse, thorn-like projections in apical fourth . . . . . *excisa* (p. 68)
- Apex of valve finely tapered, apical fourth incurved towards uncus and that part of ventral margin serrate; dorsal process with setose, spatulate projection at one-third. Ventral plate of gnathus broadly rounded. Aedeagus finely scobinate in apical fourth . . . . . *denticulata* (p. 69)
- 4 (2) Dorsal process of valve excavate and with a short, angular projection at two-thirds. Aedeagus coarsely scobinate at left side in apical third, terminal spine stout and thorn-like . . . . . *scriptifasciata* (p. 65)
- Dorsal process of valve not excavate . . . . . 5
- 5 (4) Dorsal process of valve without dilation in basal third, boldly and smoothly curved through 90 degrees to finely tapered apex. Cornutus broad and as long as greatest width of aedeagus (Text-figs 85, 86). N. India . . . . . *symmetra* (p. 68)
- Dorsal process and cornutus not so formed . . . . . 6
- 6 (5) Dorsal process of valve a little dilate in basal third, apical half evenly curved. Cornutus shorter than greatest width of aedeagus and broad with a thorn-like tip; smooth-edged (Text-figs 81, 82). Java, Malaya . . . . . *baliata* (p. 66)
- Dorsal process of valve a little dilate in basal third, and angled at two-thirds. Cornutus slender and as long as width of aedeagus, margins minutely scobinate (Text-figs 83, 84). Sumatra, Borneo . . . . . *baliata* ?subsp. (p. 66)

***Zamarada scriptifasciata* (Walker)**

(Text-figs 79, 80; Pl. 18, figs 523, 524; Pl. 100, fig. 891)

*Comibaena scriptifasciata* Walker [1863] 1862, 26 : 1566. Holotype ♀, without abdomen, SARAWAK (BMNH) [examined].

*Zamarada scriptifasciata* (Walker) Hampson, 1896 : 552.

♂♀ (Pl. 100, fig. 891). Hyaline proximal two-thirds of each wing greyish yellow lightly irrorate with greyish brown and finely edged distally with brown. Terminal non-hyaline area greyish brown (pl. 7, D3) lightly irrorate with brown; dentate subterminal fascia brown slenderly edged distally with light buff. Underside of non-hyaline terminal area of each wing uniformly brown.

♂ genitalia (Text-figs 79, 80). Dorsal process of valve excavate at two-thirds, with short angular projection. Aedeagus with two longitudinal serrate ridges in apical third, terminal tooth of one ridge stout and thorn-like. Vesica with a stout, tapered cornutus, one-third as long as aedeagus.

♀ genitalia (Pl. 18, figs 523, 524). Sterigma with three processes extending posteriorly; medial process, from lamella postvaginalis, semi-cylindrical in transverse section; longer lateral processes, from lamella antevaginalis, serrate at tips; posterior third of corpus bursae sclerotized and ribbed, remainder membranous with a stellate signum.

Measurements. Fore wing: ♂ 14-15 mm, ♀ 14 mm. Antennal pectinations: ♂ 9 ×, ♀ 7 × diameter of shaft.



Distinguished from externally similar species by the structure of the genitalia of both sexes. In the male the form of the dorsal process of the valve and the coarse scobination and stout terminal spine on the apical third of the aedeagus and in the female the form of the sterigma are diagnostic.

DISTRIBUTION. Borneo.

#### MATERIAL EXAMINED.

*Comibaena scriptifasciata* Walker, holotype ♀ [not ♂ as stated in original description], without abdomen, BORNEO (Sarawak): (*Wallace*), in BMNH.

BORNEO: Sarawak, Bidi [on Sarawak River], 1907-1908 (*C. J. Brooks*), 1 ♂; Sabah (*Pryer*), 2 ♀; Sandakan (*D. Cator*), 1 ♂.

### *Zamarada baliata* (Felder) sp. rev.

(Text-figs 81-84; Pl. 19, figs 525, 526; Pl. 100, fig. 892)

*Euchloris baliata* Felder, 1875 : 9, pl. 127, fig. 7. Holotype ♂, JAVA (BMNH) [examined].

*Zamarada translucida* Moore, 1887 : 432. LECTOTYPE ♂, ?BORNEO, ?JAVA (BMNH), here designated [examined].

*Zamarada translucida* Moore; Hampson, 1896 : 552.

♂ genitalia (Text-figs 81-84). Dorsal process of valve a little dilate in basal third, apical half evenly curved to finely tapered tip. Aedeagus with two short, serrate ridges in apical third; apex with minute, hook-like projection. Cornutus short and broad with a smooth-edged thorn-like tip in specimens from Java and Malaya (Text-fig. 82); cornutus slender and as long as width of aedeagus and with minutely scobinate lateral margins in specimens from Sumatra and Borneo (Text-fig. 84).

♀ genitalia (Pl. 19, figs 525, 526). Sterigma with three processes extending posteriorly; medial process, from lamella postvaginalis, short and broadly rounded; longer lateral processes, from lamella antevaginalis, serrate at apices. Posterior half of corpus bursae sclerotized and ribbed; remainder membranous with a stellate signum.

Measurements. Fore wing: ♂ 14-15 mm; ♀ 13-15 mm. Antennal pectinations: ♂ 14 ×, ♀ 6 × diameter of shaft.

Externally (Pl. 100, fig. 892) closely similar to *scriptifasciata*, with which it evidently occurs at Bidi in Sarawak. Examples of *baliata* from the island of Borneo and some from Sumatra differ from *scriptifasciata* in having the dentate subterminal fascia irrorate with orange-brown, but this is not a constant character for the species. Distinguished in the male genitalia by the non-excavate dorsal process on the valve, by the less coarsely scobinate ridges on the aedeagus and by the smaller cornutus on the vesica. In the female genitalia the medial process on the sterigma is shorter and not semi-cylindrical in section and the corpus bursae is more slender and more extensively sclerotized and ribbed.

The genitalia of both sexes appear to vary geographically. The males from Perak are identical with those from Java (Text-figs 81, 82); in examples from western Sumatra, the medial third of the dorsal process of the valve is straight, with the suggestion of an angle rather than a curve at two-thirds, and the cornutus is as long as the width of the aedeagus with minutely serrate edges (Text-figs 83,

84). In examples from the island of Borneo the dorsal process is identical with that of the Javanese type, but the cornutus is similar to the form found among Sumatran specimens. The female genitalia vary geographically in the form of the sterigma. For the present no subspecific name is proposed, all specimens being treated as *baliata*.

DISTRIBUTION. West Malaysia (Malaya), Singapore, Sumatra, Java, Borneo.

#### MATERIAL EXAMINED.

*Euchloris baliata* Felder, holotype ♂, JAVA, 'Novara cxxvii, fig. 7, *Euchloris baliata* n. ♂', Geometridae genitalia slide no. 6399, in BMNH. *Zamarada translucida* Moore, lectotype ♀ here designated, '60.15 E.I.C. [East India Company] [? Borneo, ? Java]: 571: *Comibaena translucida* . . .' [in Walker's hand-writing; last two words indecipherable], without abdomen, in BMNH.

WEST MALAYSIA: Pahang, Fraser's Hill, 21.iv.1958 (*W. St. J. C. Tayleur*), 1 ♂; ibidem, 3600 ft, 4.i.1960 (*H. S. Robinson*), 1 ♀; Selangor, Bukit Kutu, iv. 1915, 1 ♂; ibidem, 3300 ft (*A. R. Sanderson*), 1 ♀; ibidem, 3500 ft, iv. 1926 (*H. M. Pendlebury*), 2 ♂; Selangor (*H. E. Durham*), 1 ♀; Perak, 14 ♂, 1 ♀; Penang, Government Hill 1000 ft, v. 1893 (*Curtis*), 1 ♂. SINGAPORE, 1 ♀. RIOUW ARCHIPELAGO: Doerian, vi. 1923 (*Dammerman*), 1 ♂, 1 ♀ (RNH, Leiden). SUMATRA: Sibolga, Bonan Dolok, 500 m, 19-20.vi.1930 (*Meer Mohr*), 1 ♀ (RNH, Leiden); Padang, xi. 1924, 1 ♂; Lebong Tandai, 1920-1923 (*C. J. Brooks*), 2 ♂, 1 ♀; ibidem, 3.xii.1921, 1 ♂; Dempo, 4000 ft, viii. 1923 (*C. J. Brooks*), 1 ♀ (all BMNH); Tandjong Morawa, Serdang, (*Dr B. Hagen*), 1 ♂ (RNH, Leiden). JAVA: Mts Djampang Wetan, Radjamandala, iii. 1938 (*M. E. Walsh*), 1 ♂; Mt Djampang, Preanger, 1500-2500 ft, ii-iii. 1936 (*M. E. Walsh*), 1 ♂; Mt Gede, Goalpara, x. 1937 (*M. E. Walsh*), 1 ♀ (all BMNH); Buitenzorg, 1 ♂, 2 ♀ (RNH, Leiden). BORNEO: Sabah, 1 ♂; Mt Kinabalu, v-viii. 1903 (*John Waterstradt*), 1 ♂; Sarawak, Bidi, 1907-1908 (*C. J. Brooks*), 1 ♂ (all BMNH).

### *Zamarada fugax* Warren

(Pl. 19, figs 527, 528; Pl. 100, fig. 893)

*Zamarada fugax* Warren, 1902 : 365. Holotype ♀, TANIMBAR IS. (BMNH) [examined].

♀ (Pl. 100, fig. 893). Hyaline area of wings greyish yellow. Non-hyaline terminal third buffy brown (pl. 4, B3, sand); subterminal fascia ill-defined, represented by a grey suffusion. Underside of non-hyaline terminal area brown proximally, paler terminad.

♀ genitalia (Pl. 19, figs 527, 528). Sterigma with three processes extending posteriorly; medial process, from lamella postvaginalis, spatulate and broadly rounded at tip, almost equal in length to the two lateral processes from the lamella antevaginalis, which are serrate on their inner margins.

♂ unknown.

Measurements. Fore wing: ♀ 10 mm. Antennal pectinations: ♀ 4 × diameter of shaft.

The most easterly representative of the genus, possibly a subspecies of *baliata*.

DISTRIBUTION. Tanimbar Islands.

## MATERIAL EXAMINED.

*Zamarada fugax* Warren, holotype ♀, TANIMBAR IS: Larat (*H. Kühn*), Geometridae genitalia slide no. 6402, in BMNH.

*Zamarada symmetra* sp. n.

(Text-figs 85, 86; Pl. 20, figs 529, 530; Pl. 100, figs 895, 896)

[*Zamarada translucida* Moore sensu Hampson, 1895 : 198 (part). Misidentification.]

♂ genitalia (Text-figs 85, 86). Differ from *baliata* in the usually more finely tapered apex of the valve; in the dorsal process of the valve, which is without dilation in the basal third and in the larger cornutus, which is smooth-edged and as long as the width of the aedeagus.

♀ genitalia (Pl. 20, figs 529, 530). Differ from *baliata* in the form of the sterigma, the longer, medial process from the lamella postvaginalis being equal in length to the two serrate, lateral processes from the lamella antevaginalis.

Measurements. Fore wing: ♂ 13–15 mm; ♀ 15 mm. Antennal pectinations: ♂ 13 ×, ♀ 6 × diameter of shaft.

The type-form, consisting of a series of 5 males and 3 females, appears to be identical externally with *baliata* (Pl. 100, fig. 892). The remainder of the material examined, excluded from the type-series, consists of 18 males; these are structurally identical with the type, but differ externally in the browner, less grey colour of the patterned terminal third of each wing, in the less intensely marked subterminal fascia, in the duller, less yellow hyaline area and its deeper penetration of the terminal third, almost to the cilia. The data are brief; the only specimen of the type-series to bear a date is labelled June; of the 6 males that are similar in size to the type-series, but differ as described above, three are labelled November (Pl. 100, fig. 896); of the remaining 12 males, which are smaller and measure 13.5–14.0 mm in fore wing length and are reminiscent of *fugax* in wing pattern, three are labelled February–April (Pl. 100, fig. 895). These examples may reflect seasonal changes from the warm, wet south-west monsoon period [early June to October] to the cooler drier conditions of late October to May.

DISTRIBUTION. N.E. India.

Holotype ♂, INDIA: Khasia Hills, Geometridae genitalia slide no. 6395, in BMNH.

Paratypes. INDIA: Khasia Hills, 2 ♂, 1 ♀ (1 ♀ labelled vi. 1895) (BMNH), 1 ♂, 1 ♀ (UM, Oxford); Naga Hills (*Doherty*), 1 ♂ (BMNH).

Other material.

INDIA: Cherrapunji, xi. 1903, 3 ♂; Shillong, 1 ♂; Khasia Hills, 13 ♂ (1 ♂ labelled ii. 1895), 1 ♂, iii. 1895, 1 ♂, iv. 1895 (BMNH), 1 ♂ (UM, Oxford).

*Zamarada excisa* Hampson sp. rev.

(Text-figs 87, 88; Pl. 20, figs 531, 532; Pl. 100, figs. 897, 898)

*Zamarada excisa* Hampson, 1891 : 110. Holotype ♀, INDIA (BMNH) [examined].

*Zamarada excisa* Hampson, Hampson, 1893 : 35; 1895 : 198.

[*Zamarada translucida* Moore sensu Moore, 1887 : 432. Misidentification.]

[*Zamarada translucida* Moore sensu Singh, 1953 : 107, figs 3, 74 (larvae). Misidentification.]

♂ genitalia (Text-figs 87, 88). Ventral plate of gnathus truncate and minutely scobinate. Apex of valve spatulate and narrowly rounded; dorsal process of valve dilate and setose at one-third and angled through 90 degrees at two-thirds, the apex finely tapered. Aedeagus with coarse, thorn-like projections at one side in apical fourth. Vesica with a stout, tapered cornutus.

♀ genitalia (Pl. 20, figs 531, 532). Sterigma with three processes extending posteriorly; medial process rounded at tip and subequal in length to the two lateral, serrate-tipped processes. Posterior third of corpus bursae weakly ribbed and strongly sclerotized at one side; remainder membranous with a stellate signum.

Measurements. Fore wing: ♂ 16-18 mm; ♀ 15-18 mm. Antennal pectinations: ♂ 12 ×, ♀ 9 × diameter of shaft.

Externally similar to *scriptifasciata* and to *baliata*, differing in its larger size, in the rather paler and clearer hyaline area of each wing and its deeper, smooth-edged penetration of the terminal third between veins  $M_3$  and  $Cu_{1b}$  (Pl. 100, figs 897, 898). Structurally the form of the valve and of the aedeagus in the male genitalia and the degree of sclerotization of the corpus bursae in the female genitalia are diagnostic.

BIOLOGY. Singh (1953: 107) gives a detailed description of the larva under the name *Zamarada translucida* Moore, which he records as a defoliator of *Cassia fistula* Linnaeus (Leguminosae) in India.

DISTRIBUTION. Burma, India, Ceylon.

#### MATERIAL EXAMINED.

*Zamarada excisa* Hampson, holotype ♀, INDIA: Madras, Nilgiris (Hampson coll.), Geometridae genitalia slide no. 6394, in BMNH.

BURMA: Rangoon, i. 1924 (*W. Archbold*), 1 ♂. INDIA: Naga Hills, 1500-3000 ft, ix-x. 1889 (*W. Doherty*), 1 ♂; ibidem, 2500-7000 ft, viii. 1889, 1 ♂; Mussoorie, S. Badahur, 15.ix.1928, 1 ♂ (FRIC, Dehra Dun); Ganjam, Berhampore, iii. 1882 (*H. J. Elwes*), 1 ♂; Bombay, Belgaum (*T. R. Bell*), 1 ♀; Madras, Nilgiris (Hampson coll.), 1 ♀. CEYLON: Peradeniya, xii. 1900, 1 ♂; Kandy, 4 ♂, 3 ♀; Haputale, iv-v, 1 ♂, 1 ♀; Kegalla, 1 ♀; Wellawaya, 1 ♀; Uva, 600 ft, 1 ♀; Dambulla (Dambool), xii. 1908, 1 ♂; Anarapura, xii. 1911, 1 ♀; Maskeliya, ix, 1 ♀ (all *Mackwood* coll.); Diyatalawa Camp, 4200 ft (*Findlay*), 1 ♂.

Dr P. N. Chatterjee of the Forest Research Institute, Dehra Dun informs me that there are a further five specimens from Dehra Dun and S. Badahur in the Institute's collection.

#### *Zamarada denticulata* sp. n.

(Text-figs 89, 90; Pl. 100, fig. 894)

♂ genitalia (Text-figs 89, 90). Ventral plate of gnathus semicircular and minutely scobinate. Valve tapered apicad and curved towards uncus, apical area coarsely scobinate; apical fourth of ventral margin serrate; dorsal process of valve setose with a spatulate projection at one-third.



Aedeagus with a finely scobinate ridge on ventral surface in apical fourth. Vesica with a stout, serrate-edged, tapered cornutus.

♀ unknown.

Measurements. Fore wing: ♂ 14 mm. Antennal pectinations: ♂ 12 × diameter of shaft.

Closely similar to *scriptifasciata* and to *baliata* in size, colour and pattern; structurally closely similar to *excisa* from Ceylon, India and Burma, which it appears to represent in Borneo and Sumatra.

Distinguished from *excisa* in size and wing pattern (Pl. 100, fig. 894); in the male genitalia the serrate apical fourth of the ventral margin and the tapered, scobinate apical area of the valve and the form of the ventral plate of the gnathus are diagnostic.

DISTRIBUTION. Borneo, Sumatra.

Holotype ♂, BORNEO (Dutch West Borneo): Kalimantan, 85 miles above Penticianak (*Simons & Meligan*), Geometridae genitalia slide no. 7133, in BMNH.

Paratype. SUMATRA: Deli, 1 ♂ (RNH, Leiden).

### THE *EOGENARIA*-GROUP

All the species in the group are distributed in the Indian, Malayan, Celebes and Philippine subregions of the Oriental region. They are conspicuous externally in having the hyaline areas of the wings bright green; the fore wing measures 10–15 mm. The group is characterized in the male genitalia by the presence of a pair of spine-like processes on the dorsal surface of the uncus; the fulcrum is slender and weakly sclerotized. In the female genitalia the ductus bursae is well developed, tubular and sclerotized, equal in length to or longer than the corpus bursae.

#### KEY TO SPECIES AND SUBSPECIES

- |   |                                                                                                                                                                                              |                                    |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| 1 | Valves and projections from uncus asymmetrical . . . . .                                                                                                                                     | <i>ucata</i> (p. 73)               |
| – | Valves and projections from uncus symmetrical . . . . .                                                                                                                                      | 2                                  |
| 2 | (1) Apical fifth of valve sclerotized, finely tapered and curved through 90 degrees towards uncus. Fulcrum extending beyond tip of aedeagus, apex dilate and bilobate . . . . .              | <i>nesiotica</i> (p. 73)           |
| – | Valve tapered apicad, then broadened slightly to narrow, serrate-edged, apical margin (Text-fig. 91). Fulcrum slender and weakly sclerotized, not extending beyond tip of aedeagus . . . . . | 3                                  |
| 3 | (2) Dentate subterminal fascia not interrupted by penetration of green hyaline area between veins $M_3$ and $Cu_{1b}$ . Distribution: Celebes, Sumatra, Java, Borneo, Malaya . . . . .       | <i>eogenaria eogenaria</i> (p. 71) |
| – | Dentate subterminal fascia interrupted by penetration of green hyaline area between veins $M_3$ and $Cu_{1b}$ . Distribution: India, Burma.                                                  | <i>eogenaria cosmiaria</i> (p. 72) |

### *Zamarada eogenaria* (Snellen)

(Text-figs 91–94; Pl. 21, figs 533, 534; Pl. 101, figs 900–902)

*Phorodesma eogenaria* Snellen, 1881 : 78, pl. 10, fig. 1.

♂ ♀ (Pl. 101, figs 900-902). Hyaline area of wings greyish green (pl. 28, B4-5) slenderly edged distally with silvery grey; costa of each wing buff lightly irrorate with brown; discal spots minute, black. Non-hyaline terminal area brownish grey irrorate with brownish orange; subterminal fascia dentate anterior of vein  $M_3$  and posterior of  $Cu_{1b}$ , brownish orange edged distally with light buff, extent of marking varying geographically. Underside of non-hyaline terminal area of each wing dark brown, corresponding in width with the patterned terminal area of the upperside.

♂ genitalia (Text-figs 91-94). Gnathus without ventral plate. Valve with slender, tapered process at two-thirds dorsal margin, varying geographically. Fulcrum simple, weakly sclerotized and arising at two-thirds aedeagus. Vesica with a cluster of short, thorn-like spines.

♀ genitalia (Pl. 21, figs 533, 534). Tapered, digitate process with a narrowly rounded apex extends posteriorly from sterigma.

Measurements. Fore wing: ♂ 10-15 mm; ♀ 10-13 mm. Antennal pectinations: ♂ 14.5-17.0 ×, ♀ 5 × diameter of shaft.

DISTRIBUTION. India, Burma, W. Malaysia, Sumatra, Java, Borneo, Celebes.

Two subspecies are recognized, distinguished by size, wing-pattern and structure of the male genitalia.

### *Zamarada eogenaria eogenaria* (Snellen)

(Text-figs 91, 92; Pl. 101, fig. 900)

*Phorodesma eogenaria* Snellen, 1881: 78, pl. 10, fig. 1. LECTOTYPE ♂, CELEBES (RNH, Leiden), here designated [examined].

[*Zamarada translucida* Moore, 1887: 432 (part). Misidentification.]

♂ ♀ (Pl. 101, fig. 900). Non-hyaline terminal area of each wing greyish orange (pl. 5, B5) distally, brownish grey (pl. 7, C2) proximally; dentate subterminal fascia brown (pl. 6, E7-8) edged distally with light buff, not interrupted by shallow penetration of green hyaline area between veins  $M_3$  and  $Cu_{1b}$ . In the male genitalia the cleft in the uncus is equal in depth to the width of one of the lobes and the slender process arising from the valve and inclined dorsad is equal to one-third of the dorsal margin of the valve.

Measurements. Fore wing: ♂ 10-12 mm; ♀ 10-11 mm. Antennal pectinations: ♂ 14.5 ×, ♀ 5 × diameter of shaft.

Specimens from Malaysia, Sumatra, Java and Borneo are intermediate between the nominate subspecies and ssp. *cosmiaria*, approaching the nominate subspecies in size and colour and occasionally in pattern, but approaching ssp. *cosmiaria* in the structure of the male genitalia.

DISTRIBUTION. Celebes, Borneo, Java, Sumatra, Singapore, West Malaysia.

#### MATERIAL EXAMINED.

*Phorodesma eogenaria* Snellen, lectotype ♂ here designated, CELEBES: Bonthain, '*Phorodesma eogenaria* Snellen syntype ♂' [in Dr A. Diakonoff's hand-writing], in RNH, Leiden.

CELEBES: Maros (*Phorodesma eogenaria* Snellen, paralectotype), 1 ♀ (RNH, Leiden); Pangean, near Maros, 2000 ft, iii. 1938 (*J. P. A. Kalis*), 41 ♂, 17 ♀; Tjamba,

near Maros, 1500 ft, ii. 1938 (*J. P. A. Kalis*), 7 ♂, 2 ♀ (all BMNH). BORNEO: Mount Kina Balu, v-viii. 1903 (*John Waterstradt*), 1 ♂ (BMNH). PULO LAUT: vi. 1891 (*Doherty*), 1 ♂ (BMNH). JAVA: (*Zamarada translucida* Moore, paralectotype): Horsfield, *Rathalla* [unpublished generic name] *translucida* type ♂ Moore [Moore's hand-writing]: Moore Coll. 94-106: Moore's allotype of *translucida*, but not agreeing with figure and description. L.B.P. [L. B. Prout's handwriting], 1 ♂; Mons Gede, 4000 ft, viii. 1892 (*H. Fruhstorfer*), 1 ♀; Mts Djampang Wetan, Radjamandala, iii. 1938 (*M. E. Walsh*), 1 ♀; Radjamandala, 1200 ft, xii. 1938 (*M. E. Walsh*), 1 ♂ (all BMNH); Java, 2 ♂; Batavia, 1887, 1 ♀; ibidem, 1885, 1 ♀; Buitenzorg, 1886, 1 ♀; Tegal, Kemanglen, viii. 1889 (*Lucasson*), 1 ♂ (all RNH, Leiden). SUMATRA: Padang, 1 ♂; ibidem, xi. 1924, 1 ♂ (BMNH). SINGAPORE: Bukit Timah, 18.iv.1958 (*W. St. J. C. Tayleur*), 1 ♂. WEST MALAYSIA: Penang, Government Hill, 1000 ft, v. 1898 (*Curtis*), 1 ♂; Kedah Peak, 3200 ft, xii. 1915, 1 ♂; Selangor, Bukit Kutu, 15.iv.1926 (*H. M. Pendlebury*), 1 ♂ (all BMNH).

### *Zamarada eogenaria cosmiaria* Swinhoe

(Text-figs 93, 94; Pl. 101, figs 901, 902)

*Zamarada cosmiaria* Swinhoe, 1893 : 155. Holotype ♂, INDIA (BMNH) [examined].

*Zamarada cosmiaria* Swinhoe; Hampson, 1895 : 199.

*Zamarada cosmiaria* Swinhoe; Swinhoe, 1894 : 210, pl. 2, fig. 3.

*Zamarada tenuimargo* Swinhoe, 1906 : 379. LECTOTYPE ♂, INDIA (BMNH), here designated [examined]

♂ ♀ (Pl. 101, figs 901, 902). Distinguished from the nominate subspecies by the deeper penetration by the green hyaline area of the terminal third of each wing between veins  $M_3$  and  $Cu_{1b}$ , breaking completely the subterminal fascia; non-hyaline terminal area suffused proximally, especially in apical half of fore wing, with a greyer brown than is found in the nominate subspecies. In some examples (Pl. 101, fig. 902) the non-hyaline area is reduced to a slender band; such specimens are referable to ab. *tenuimargo* Swinhoe. In the male genitalia the cleft in the uncus is one-half to two-thirds as deep as the width of one of the lobes and the slender process arising from the valve is equal to one-fourth of the dorsal margin of the valve.

Measurements. Fore wing: ♂ 12-15 mm; ♀ 13 mm. Antennal pectinations: ♂ 17 ×, ♀ 5 × diameter of shaft.

DISTRIBUTION. India, Burma.

#### MATERIAL EXAMINED.

*Zamarada cosmiaria* Swinhoe, holotype ♂, INDIA: Khasia Hills, Geometridae genitalia slide no. 6382, in BMNH. *Zamarada tenuimargo* Swinhoe, lectotype ♂ here designated, INDIA: Khasia Hills, 1906-118, '*Zamarada tenuimargo* Swinhoe ♂ type' [in Swinhoe's hand-writing], Geometridae genitalia slide no. 6381, in BMNH.

INDIA: Assam, 7 ♂ (BMNH), 1 ♂ (RNH, Leiden); Khasia Hills, 20 ♂, 1 ♀ (BMNH), 4 ♂, 2 ♀ (UM, Oxford); Shillong, 1 ♂; Cherrapunji, 6 ♂; ibidem, x. 1893, 2 ♂; xi. 1893, 14 ♂; xii. 1893, 1 ♂ (BMNH), 1 ♂ (UM, Oxford); Imphal, Manipur, 2600 ft, 12.xii.1912 (*Col. H. C. Tytler*), 1 ♂; Naga Hills, 1500 ft, ix-x. 1889, 3 ♂. BURMA: S. Tenasserim, Victoria, 1 ♂.

*Zamarada nesiotica* sp. n.

(Text-figs 95, 96; Pl. 21, figs 535, 536; Pl. 101, figs 903, 904)

Similar in size to *eogenaria cosmiaria* from N. India, but with the broader non-hyaline terminal area of *eogenaria eogenaria*; in *nesiotica* the non-hyaline terminal area is paler brown in the male, distad of the subterminal fascia (Pl. 101, figs 903, 904).

The male genitalia differ from those of *eogenaria*, with which it occurs on Pulo Laut, in the form of the valve; the apex is strongly sclerotized, finely tapered and incurved through 90 degrees towards the uncus; the process arising on the valve at two-thirds is longer than that found in *eogenaria*. The fulcrum differs with its dilate and bilobate apex. The vesica is minutely scobinate. The female genitalia differ from those of *eogenaria* in the shorter ductus bursae and in the form of the asymmetrical sterigma.

Measurements. Fore wing: 12.0–14.5 mm (one ?starving 9 mm), ♀ 12.5–14.5 mm. Antennal pectinations: ♂ 14 ×, ♀ 8 × diameter of shaft.

DISTRIBUTION. Philippine Is., Pulo Laut.

Holotype ♂, PHILIPPINE IS.: Luzon, Benguet, Klondyke, 800 ft, 26.xii.1911 (*A. E. Wileman*), Geometridae genitalia slide no. 7101, in BMNH.

Paratypes. PHILIPPINE IS.: Luzon, prov. Rizal, Montalban, 12.i.1914 (*A. E. Wileman*), 1 ♂; ibidem, 13.i.1914, 1 ♂; 1.ii.1914, 1 ♀; holotype data, 23.iii.1912, 1 ♂; ibidem, 23.v.1912, 8 ♂, 2 ♀; 17.xii.1911, 1 ♂; 18.xii.1911, 1 ♂; 19.xii.1911, 3 ♂, 2 ♀; 20.xii.1911, 2 ♂, 1 ♀; 21.xii.1911, 2 ♂, 1 ♀; 23.xii.1911, 7 ♂, 2 ♀; 25.xii.1911, 4 ♂, 2 ♀; 26.xii.1911, 4 ♂, 2 ♀; 29.xii.1911, 2 ♂; Palawan, Taytay, 6.x.1913 (*A. E. Wileman*), 1 ♀; Palawan (*Doherty*), 1 ♀.

The following specimens are associated with *nesiotica*, but excluded from the type-series: PULO LAUT (*Doherty*), 1 ♀; ibidem, vi. 1891 (*Doherty*), 1 ♂.

*Zamarada ucata* sp. n.

(Text-figs 97, 98; Pl. 22, figs 537, 538; Pl. 101, fig. 905)

♂ genitalia (Text-figs 97, 98). Tapered projections from dorsal surface of uncus asymmetrical. Fultura superior broadly and strongly sclerotized. Valves asymmetrical, as illustrated. Apex of aedeagus tapered, serrate at one side. Fulcrum similar to that of *nesiotica*. Vesica minutely scobinate with two small, thorn-like cornuti medially.

♀ genitalia (Pl. 22, figs 537, 538).

Measurements. Fore wing: ♂ 12–15 mm; ♀ 11–12 mm. Antennal pectinations: ♂ 15 ×, ♀ 8 × diameter of shaft.

Closely similar in size, colour and pattern to *nesiotica*; distinguished externally from Malaysian and Indonesian representatives of *eogenaria*, with which it occurs, by its larger size and strongly contrasted dark grey and buff chequered cilia (Pl. 101, fig. 905). In the male genitalia the form of the uncus and valves and in the female the form of the sterigma are diagnostic; these structural characters are usually visible in the dry state.

DISTRIBUTION. West Malaysia, Singapore, Sumatra, Java, Borneo.



Holotype ♂, WEST MALAYSIA: Perak, vii-viii. 1895 (*Lakatt & Pamboo*), Geometridae genitalia slide no. 7112, in BMNH.

Paratypes. WEST MALAYSIA: Penang, xi. 1896 (*Curtis*), 1 ♂, 1 ♀; ibidem, 7.xii.1898, 1 ♂; Penang, 2260 ft, 3.xii.1898 (*S. S. Flower*), 1 ♂; Penang, xii. 1915-ii. 1916 (*C. L. Collette*), 1 ♂; Penang Hill, 2400 ft, iv-v. 1937 (*M. R. Henderson*), 1 ♂; Perak, holotype data, 1 ♂; Perak 2000-3500 ft (*W. Doherty*), 1 ♂; Perak, Larut Hills, 3700 ft, 10.ii.1932 (*H. M. Pendlebury*), 1 ♂; Selangor, Bukit Kutu, 3300 ft, 23.ix.1932 (*H. M. Pendlebury*), 1 ♀; ibidem (*A. R. Sanderson*), 1 ♂, 1 ♀. SINGAPORE: 1 ♂; ibidem (*H. N. Ridley*), 3 ♀. RIOUW ARCHIPELAGO: Doerian, vi. 1923 (*Dammerman*), 1 ♀ (RNH, Leiden). SUMATRA: Brastagi [4500 ft] (*Mrs P. G. Souter*), 1 ♂; Padang, Sidempoean, xii. 1902-i. 1903, 1 ♂; Padang, 1 ♂; Lebong Tandai, 1920-1923 (*C. J. Brooks*), 1 ♂, 2 ♀; ibidem, 23-30.iv.1921, 1 ♂ (all BMNH); Wai Lima, Z. Sum., Lampongs, xi-xii. 1921 (*Karny*), 1 ♂ (RNH, Leiden). JAVA: (*Blume*), 2 ♂ (RNH, Leiden); Java, Coll. Piepers-Snellen, 1 ♂ (RNH, Leiden); E.I.C. [East India Company], ? Java, 1 ♂ (BMNH); Soekaboemi, 1800 ft, ii-iii. 1936 (*M. E. Walsh*), 1 ♀; Preanger, Mt Djampang, 1500-2500 ft, ii-iii. 1936 (*M. E. Walsh*), 1 ♂; Mts Djampang Wetan, Bibidjilan, xii. 1937 (*M. E. Walsh*), 1 ♀ (all BMNH); Batavia, 1884, 1 ♂, 1 ♀; ibidem, 1888, 1 ♀; Buitenzorg, Bogor, 1 ♂, 1 ♀ (all RNH, Leiden); Buitenzorg, 800 ft, iv. 1923 (*H. M. Pendlebury*), 1 ♂ (BMNH); Java merid., 1500 ft, 1891 (*H. Fruhstorfer*), 1 ♂ (UM, Oxford), 1 ♀ (BMNH). BORNEO: Labuan (*Pryer*), 1 ♂; Elopura (*Pryer*), 1 ♂; Brit. N. Borneo (*Pryer*), 1 ♀ (UM, Oxford); Sarawak (*Wallace*), 1 ♀; Sandakan (*D. Cator*), 1 ♀; Bidi, 1907-1908 (*C. J. Brooks*), 1 ♀; foot Mt Dulit, junction of rivers Tinjar & Lejok, 27.ix.1932 (*B. M. Hobby & A. W. Moore*), 1 ♂; 85 miles above Pontianak (*Simons & Meligan*), 1 ♂.

### THE FLAVICOSTA-GROUP

In each of the four included species the hyaline area of the wings is tinged with yellowish green; the non-hyaline terminal area is predominantly greyish red with a well marked cinnamon-coloured subterminal fascia; the fore wing measures 14-18 mm in the male, 12-17 mm in the female. The species-group is characterized in the male genitalia by the long, slender uncus, the slender arms of the gnathus that fuse medially without forming a ventral plate and the asymmetrical valves, which are digitate on the left-hand side and bifurcate or dilate and incurved on the right-hand side. In the female genitalia there is a hollow process, anteriorly inclined and tapered, at the right-hand side of the sterigma that might engage the fulcrum during copulation.

### KEY TO SPECIES AND SUBSPECIES

- |       |                                                                                                                           |                           |
|-------|---------------------------------------------------------------------------------------------------------------------------|---------------------------|
| 1     | Right valve bifurcate, twin apices equal or unequal; dorsal process grossly dilate and setose in basal third . . . . .    | 2                         |
| -     | Apex of right-hand valve rounded, narrowly or broadly; dorsal process a little dilate and setose in basal third . . . . . | 3                         |
| 2 (1) | Apex of right valve with two tapered arms equal in length. Fulcrum shorter than aedeagus . . . . .                        | <i>flavicosta</i> (p. 75) |

- Apex of right valve roundly excavate, margins produced in digitate form; dorsal extension two-thirds as long as uncus, ventral extension very short. Fulcrum extending just beyond tip of aedeagus . . . *indicata* (p. 76)
- 3 (1) Apex of fulcrum densely and shortly scobinate, the spines never longer than one-half of width of fulcrum. Right valve narrowed to one-fifth of its greatest width just below disc-like apex . . . *schalida* (p. 79)
- Apex of fulcrum long-spined, many spines twice as long as width of fulcrum. Right valve narrowed below apex, but never to less than one-third of its greatest width . . . 4
- 4 (3) Apex of right valve three times as broad as that of left valve. Distal margin of hyaline area of each wing very shallowly lunulate; non-hyaline terminal area rarely excavate between veins  $M_3$  and  $Cu_{1b}$ . Distribution: Guinea to Ghana. . . *regularis regularis* (p. 78)
- Apex of right valve twice as broad as that of left valve. Non-hyaline terminal area of each wing excavate between veins  $M_3$  and  $Cu_{1b}$ . Distribution: Nigeria . . . *regularis arcuata* (p. 78)

### *Zamarada flavicosta* Warren

(Text-figs 99, 100; Pl. 23, figs 541, 542; Pl. 101, figs 906, 907; Map 2)

*Zamarada flavicosta* Warren, 1897 : 122. LECTOTYPE ♀, NIGERIA (BMNH), here designated [examined].

*Zamarada flavicosta* Warren; Swinhoe, 1904 : 515 (part).

♂ ♀ (Pl. 101, figs 906, 907). Hyaline area of wings tinged with yellowish green, finely edged distally with yellow, then dark brown and silvery grey; costa of fore wing yellow irrorate with a vinaceous grey; discal spots minute, black. Non-hyaline terminal area greyish red (pl. 7, B3); dentate subterminal fascia light brown (pl. 6, D6, cinnamon), strongly marked in apical half of each wing, at tornus of fore wing and at anal angle of hind wing, and finely edged distally with glossy buff; cilia chequered grey and yellow, the grey markings in the discal area being smaller than at other parts of the termen. Underside of non-hyaline terminal area uniformly dark brown; cilia as on upperside.

There is variation in the extent and form of the hyaline excavation of the terminal area of each wing, shallow and lunulate, angular (Pl. 101, fig. 907) as in the lectotype and deep and boldly curved. The ten examples from Entebbe and Kampala in Uganda are larger (Pl. 101, fig. 906) than most of the West African series, having a fore wing length of 16.0–18.5 mm in the male and 16 mm in the female. The fore wing length of the West African series measures 14.0–16.5 mm in the male and 12–16 mm in the female.

♂ genitalia (Text-figs 99, 100). Juxta almost triangular. Valves asymmetrical; mid-dorsal margin of left valve and mid-ventral margin of right valve scobinate; dorsal process grossly dilate and setose in basal third. Fulcrum subequal in length to aedeagus, coarsely scobinate at apex.

♀ genitalia (Pl. 23, figs 541, 542). Asymmetrical sterigma overlaid by and fused with a sclerotized plate, which is crenulate along its posterior margin; an anteriorly inclined, hollow, talon-like process at right side.

Measurements. Fore wing: ♂ 14.0–18.5 mm; ♀ 12–16 mm. Antennal pectinations: ♂ 15 ×, ♀ 7 × diameter of shaft.

Most examples, especially those with either the shallow and lunulate or the angular hyaline excavation of the non-hyaline terminal area, may be distinguished from the sympatric *schalida* by wing pattern; the form with the angular hyaline excavation of the non-hyaline terminal area is identical in wing pattern with the

allopatric *indicata*. Distinguished structurally from both species by the form of the valves in the male genitalia and by the form of the sterigma in the female genitalia.

The syntypic series consists of three females, not one male and two females as recorded in the original description, and the date of capture is June 1896 not February 1896. The female recorded as having 'the sinus of the fore wings bilobed and shallow' has proved to be a specimen of *regularis* sp. n. One of the other two females has been selected as lectotype and is designated above.

The specimens recorded by Swinhoe (1904 : 515) represent two species; those from Nigeria are *flavicosta*, the female from Sierra Leone is *indicata* sp. n.

The specimen recorded by Hampson (1910 : 470) from Zambia cannot now be recognized, but it was unlikely to have represented *flavicosta*.

DISTRIBUTION (Map 2). Nigeria, Cameroun, Gabon, Zaire, Uganda.

#### MATERIAL EXAMINED.

*Zamarada flavicosta* Warren, lectotype ♀, NIGERIA ('Niger C.P.'): Warri, vi. 1896 (*Dr Roth*): *Zamarada flavicosta* Warr. Type ♂ [in Warren's hand-writing]: Rothschild Bequest B.M. 1939-1: Geometridae genitalia slide no. 6361, in BMNH.

NIGERIA: Lagos, 30.vii.1906 (*G. L. Boag*), 1 ♂ (BMNH); Nr Lagos 25.iii.1911 (*W. A. Lamborn*), 1 ♂ (UM, Oxford); Iju, ii. 1961 (*J. Boorman*), 1 ♂; Ifu, v. 1958 (*J. Boorman*), 1 ♂; Warri, iv. 1896 (*Dr Roth*), 1 ♀ (paralectotype of *Zamarada flavicosta* Warren); ibidem, iv. 1897, 3 ♀; Niger, Degama (*Dr. Ansorge*), 2 ♀; R. Niger, Sapele (*F. W. Sampson*), 2 ♂; Ikom, ii. 1957 (*J. Boorman*), 1 ♂; Old Calabar (*F. G. Pudney*), 1 ♂. CAMEROUN: 8 km N. d'Edea, 30.iii-1.iv.1970 (*C. Herbulot*), 1 ♂; Savanes d'Akak, 14 km N.N.E. Yaoundé, 28.viii.1971 (*P. Darge*), 1 ♂ (both coll. Herbulot, Paris); Efulen, 26.x.1922 (*H. L. Weber*), 1 ♂ (CM, Pittsburgh); Bitje, dry season, 1 ♀; ibidem, v-vi, wet season, 1 ♂ (both BMNH). GABON: Franceville, 10.xi.1963 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris). ZAIRE ('Belgian Congo'): W. Kivu, Upper Lowa Valley, nr Masisi, 5-6000 ft, forest and long grass, ii. 1924, wet season (*T. A. Barns*), 1 ♂. UGANDA: Kampala, 9.viii.1949 (*D. G. Sevastopulo*), 1 ♂; ibidem, 26.iii.1953, 1 ♀ (all BMNH); Entebbe, ix. 1954 (*J. Burgess*), 1 ♀; ibidem, xi. 1962 (*E. S. Brown*), 1 ♂ (both NMK, Nairobi); Entebbe, vi. 1961, 4 ♂ (NMR, Bulawayo); Entebbe, Zika Forest, vi. 1961, 2 ♂ (NMR, Bulawayo).

#### *Zamarada indicata* sp. n.

(Text-figs 101, 102; Pl. 23, figs 543, 544; Map 2)

[*Zamarada flavicosta* Warren sensu Swinhoe, 1904 : 515 (part). Misidentification.]

[*Zamarada flavicosta* Warren sensu Herbulot, 1954 : 329. Misidentification.]

♂ ♀. Apparently identical in colour and pattern with *flavicosta*. Distinguished externally in the male by the slightly longer pectinations of the antennae and structurally in both sexes by the genitalia. The distributions of the two species do not appear to overlap.

♂ genitalia (Text-figs 101, 102). Distinguished from *flavicosta* by the form of the valves; the digitate apex of the left valve is smooth, not scobinate as in *flavicosta*; the right valve

is unequally bifurcate, the dorsal margin being produced in digitate form, the extension two-thirds as long as the uncus, the ventral extension being short. Distinguished further by the more finely tapered, slightly spiral aedeagus and the longer fulcrum.

♀ genitalia (Pl. 23, figs 543, 544). Distinguished from *flavicosta* by the form of the finely scobinate, asymmetrical, sclerotized plate which overlies the operculum. An anteriorly inclined, hollow, talon-shaped process is situate at the right side, just posterior of operculum.

Measurements. Fore wing: ♂ 16.0–17.5 mm; ♀ 15–17 mm. Antennal pectinations: ♂ 17 ×, ♀ 6 × diameter of shaft.

DISTRIBUTION (Map 2). Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana.

Holotype ♂, IVORY COAST: Bingerville, xi. 1913 (*Gaston Melou*), Geometridae genitalia slide no. 6374, in BMNH.

Paratypes. GUINEA: Beyla (*Dr Mir Mrázek*), 1 ♂ (MM, Brno); Macenta, 2000 ft, 2–21.v.1926 (*C. L. Collenette*), 5 ♀ (BMNH). SIERRA LEONE: 1 ♀ (UM, Oxford); Bambawo, 13.vi.1969, 1 ♂; Bo, vi–vii. 1969, 1 ♂, 1 ♀, all (*R. Revell*); Freetown, x–xii. 1968 (*D. F. Owen*), 3 ♂, 2 ♀ (all BMNH). LIBERIA: Simbek, 16.v.1909 (*A. Pearse*), 1 ♀ (BMNH); Marshall Terr., Harbel, 9–31.iii.1956 (*R. M. Fox*), 10 ♂, 14 ♀; ibidem, 4–11.iv.1956, 1 ♂, 3 ♀; ibidem, 9.vi.1956, 1 ♀ (all CM, Pittsburgh). IVORY COAST: Bingerville, 20.v–11.vi.1915 (*G. Melou*), 1 ♂, 13 ♀; ibidem, vii. 1915, 3 ♀; 16–18.viii.1915, 1 ♀; 11–15.ix.1915, 1 ♀; xi. 1915, 5 ♂, 17 ♀; 1913, 6 ♀; 1914, 10 ♀ (all BMNH); Yapo-Sud, 22 km S.S.E of Agboville, 12–18.iv.1969 (*C. Herbulot*), 5 ♀ (coll. Herbulot, Paris). GHANA: Ashanti, Goaso (*G. N. Gibbs*), 1 ♀; Kumasi (Coomassie) (*H. Whiteside*), 2 ♂, 4 ♀; Wassaw, 45 miles inland from Sekondi, 1 ♀; Sekondi, 1 ♂; A'Koon, 23.xii.1918 (*Harrison*), 1 ♂ (all BMNH).

### *Zamarada regularis* sp. n.

(Text-figs 103–105; Pl. 24, figs 545–548; Pl. 102, figs 909, 910; Map 2)

*Zamarada flavicosta* Warren ab. *regularis* Warren, 1909 : 115.

♂ ♀ (Pl. 102, figs 909, 910). Colour and discal spotting of hyaline area and colours of non-hyaline terminal area closely similar to those of *flavicosta* and *indicata*. Cilia yellow, clear and unmarked in discal area of each wing and at tornus of fore wing; chequered with grey between vein-ends elsewhere.

♂ genitalia (Text-figs 103–105). Uncus long and slender, slightly dilate at mid-length. Juxta digitate. Valves asymmetrical; dorsal process slightly dilate and densely setose in basal third. Apical fourth of aedeagus narrowed and tapered. Apical three-eighths of fulcrum coarsely scobinate, many spines twice as long as width of fulcrum.

♀ genitalia (Pl. 24, figs 545–548). Sterigma asymmetrical, overlaid by a weakly sclerotized transversely ribbed plate; lamella antevaginalis asymmetrically bifurcate and fused with a more heavily sclerotized, crenulate plate at base; a weakly sclerotized, anteriorly inclined, hollow, talon-shaped process at right side.

Measurements. Fore wing: ♂ 14–16 mm; ♀ 13.5–16.0 mm. Antennal pectinations: ♂ 15 ×, ♀ 5 × diameter of shaft.

DISTRIBUTION (Map 2). Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Nigeria.



Two subspecies are recognized, distinguished externally by wing-pattern and structurally by minor modifications of the genitalia of both sexes.

***Zamarada regularis regularis* subsp. n.**

(Text-figs 103, 104; Pl. 24, figs 545, 546; Pl. 102 fig. 909; Map 2)

*Zamarada flavicosta* Warren ab. *regularis* Warren, 1909 : 115.

♂♀ (Pl. 102, fig. 909). Distal margin of hyaline area on each wing very shallowly lunulate, non-hyaline terminal area not excavate between veins  $M_3$  and  $Cu_{1b}$ ; dentate subterminal fascia unbroken.

In the male genitalia the apex of the right valve is three times as broad as that of the left valve.

In the female genitalia the ratio of the width of the crenulate, strongly sclerotized basal plate to the width of the lamella antevaginalis is 3 : 2.

Measurements. Fore wing: ♂ 14.0–15.5 mm; ♀ 13.5–15.0 mm.

DISTRIBUTION (Map 2). Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana.

Holotype ♀, GHANA ('Gold Coast'): Wassaw District, 45 miles inland from Sekondi, '*Zamarada flavicosta* ab. *regularis* Warr. type ♀' [in Warren's hand-writing], Geometridae genitalia slide no. 6358, in BMNH.

Paratypes. GUINEA: Beyla (*Dr Mir. Mrázek*), 2 ♂, 1 ♀ (MM, Brno); Macenta, 2000 ft, 2–21.v.1926 (*C. L. Collenette*), 1 ♀ (BMNH). SIERRA LEONE: 1 ♂; Moyamba (*D. Cator*), 1 ♂ (both paratypes of *Zamarada flavicosta* ab. *regularis* Warren); Bambawo, 13.vi.1969 (*R. Revell*), 1 ♂; Bo, vi. 1969 (*R. Revell*), 1 ♂; Freetown, x–xii. 1968 (*D. F. Owen*), 5 ♂, 1 ♀ (all BMNH); Kennema, Railway District, c. 200 ft, v–xi. 1911 (*Mrs Addison*), 2 ♀ (UM, Oxford). LIBERIA: Marshall Terr., Harbel, 26.iii.1957 (*R. M. Fox*), 1 ♀ (CM, Pittsburgh). IVORY COAST: Bingerville, 25.v–3.vi.1915 (*G. Melou*), 1 ♂, 3 ♀; ibidem, 1–11.vi.1915, 13 ♀; 1–5.viii.1915, 1 ♀; ix. 1913, 1 ♂; xi. 1913, 2 ♀; 1914–1915, 6 ♀ (all BMNH); Yapo-Sud, 22 km S.S.E. Agboville, 12–18.iv.1969 (*C. Herbulot*), 3 ♂, 10 ♀; Lamto, 36 km N.N.W. Tiassalé, 12–18.iv. 1969 (*C. Herbulot*), 1 ♀ (all coll. Herbulot, Paris). GHANA: Kumasi, 1–20.v (*Lt. Sanders*), 1 ♂; 20 miles W.N.W. Sekondi (*L. R. Tesch*), 1 ♀; Aburi, 17.iii.1911 (*L. Armstrong*), 1 ♀ (all BMNH).

***Zamarada regularis arcuata* subsp. n.**

(Text-fig. 105; Pl. 24, figs 547, 548; Pl. 102, fig. 910; Map 2)

[*Zamarada flavicosta* Warren sensu Warren, 1897 : 122 (part, nec lectotype). Misidentification.]

♂♀ (Pl. 102, fig. 910). Distinguished externally from the nominate subspecies by the excavation of the non-hyaline terminal area of each wing between veins  $M_3$  and  $Cu_{1b}$ , shallow on the fore wing, deeper on the hind wing. Distinguished structurally in the male genitalia by the less broad apex of the right-hand valve, which is twice or slightly less than twice as broad as that of the left valve, and in the female genitalia by the less broad, crenulate, strongly sclerotized basal plate on the sterigma; ratio of width of plate to that of lamella antevaginalis, 3 : 4.

Measurements. Fore wing: ♂ 15–16 mm; ♀ 14–16 mm.

Most reliably distinguished from examples of *flavicosta* with shallowly excavate non-hyaline terminal areas by the genitalia.

DISTRIBUTION (Map 2). Nigeria.

Holotype ♂, NIGERIA (Lower Nigeria): Old Calabar (*F. G. Pudney*), Geometridae genitalia slide no. 7851, in BMNH.

Paratypes. NIGERIA: Lagos, Ebute Meta, 17.vii.1906 (*G. L. Boag*), 1 ♀; Ikom, 7.v.1930 (*E. Haig*), 1 ♀; Warri, vi. 1896 (*Dr Roth*) (*Zamarada flavicosta* Warren, paralectotype), 1 ♀; Warri, iv. 1897, 1 ♂, 3 ♀; R. Niger, Sapele (*F. W. Sampson*), 1 ♀; holotype data, 1 ♂ (all BMNH); Calabar, vi. 1961 (*G. Markham*), 1 ♂ (NMK, Nairobi).

### *Zamarada schalida* sp. n.

(Text-figs 106, 107; Pl. 22, figs 539, 540; Pl. 101, fig. 908; Map 2)

♂♀ (Pl. 101, fig. 908). Colour and discal spotting of hyaline area and colours of non-hyaline area similar to those of other species in the *flavicosta*-group, but distinguished by the shape and depth of the excavation of the non-hyaline terminal area of each wing between veins  $M_3$  and  $Cu_{1b}$ .

♂ genitalia (Text-figs 106, 107). Distinguished from closely similar *regularis* by the more slender, asymmetrical apices of the valves, the shorter narrowed apical part of the aedeagus and the markedly denser and shorter scobination in the apical third of the fulcrum.

♀ genitalia (Pl. 22, figs 539, 540). Distinguished by the strongly developed, Y-shaped projection from the sterigma.

Measurements. Fore wing: ♂ ♀ 14–16 mm. Antennal pectinations: ♂ 13 ×, ♀ 8 × diameter of shaft.

DISTRIBUTION (Map 2). Cameroun, Gabon, Zaire.

Holotype ♂, CAMEROUN ('Kamerun'): Johann-Albrechts Höhe, 1898 (*L. Conradt*), Geometridae genitalia slide no. 7857, in BMNH.

Paratypes. CAMEROUN: holotype data, 1 ♂, 1 ♀ (BMNH); Efulen, 5.iv.1923 (*H. L. Weber*), 1 ♂; ibidem, 20.xi.1914, 1 ♀ (both CM, Pittsburgh). GABON: rives Ivindo, 35 km S. Makokou, 2.v.1963 (*G. Bernardi*), 1 ♀ (MBG, Paris). ZAIRE ('Belgian Congo'): Equateur, Flandria, vi. 1934 (*R. P. Hulstaert*), 1 ♂ (MRAC, Tervuren); W. Kivu, Nr Masisi, Upper Lowa Valley, 5–6000 ft, forest and long grass, ii. 1924, wet season (*T. A. Barns*), 1 ♀ (BMNH).

There is also a pair without data from the Holland collection (CM, Pittsburgh).

### THE EXCAVATA-GROUP

Species in the *excavata*-group have the patterned, non-hyaline terminal area of each wing deeply excavate between veins  $M_3$  and  $Cu_{1b}$ ; the hyaline area varies in colour from greyish green to dull yellow. The range of the fore wing length is 12–19 mm. The group is characterized in the male genitalia by the form of the

gnathus, in which the arms are tapered and fuse medially to form a weakly sclerotized band in place of a ventral plate. The uncus is pyriform, modified in *oxybeles* and *setosa*, where the apical half is more slender, and in *melpomene*, where the base is less dilate. The dorsal margin of the valve is usually sclerotized and the apical part scobinate; in *setosa* and *incompta* the valves are weakly sclerotized and setose, without scobination; the dorsal surface of the valves is not densely clothed with hair-scales; the hair-scales of the coremata are light buff, greyish yellow or black. The aedeagus is usually well sclerotized and tapered in the apical half, except in *oxybeles* and *melpomene* where the apex is rounded, with one or more processes arising at about two-thirds of its length. Vesica with or without cornuti. The hind tibia in the male is simple in some species, dilate and ornamented with a pencil of long hair-scales in others.

In the female genitalia the sterigma usually bears spiculate-edged folds and one or more digitate projections or dilations extending anteriorly; the projections are wanting in *melpomene*, *subinterrupta* and *fibulata*; the posterior region of the corpus bursae is sclerotized.

#### KEY TO SPECIES AND SUBSPECIES

- |       |                                                                                                                                                                                                                                                                                  |                               |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| 1     | Apical half of valve wholly membranous or very weakly sclerotized, ventral and dorsal margins parallel, setose but never scobinate; apex evenly rounded; basal half of dorsal margin weakly sclerotized, smooth, minutely scobinate or with a coarsely scobinate ridge . . . . . | 2                             |
| -     | Apical half of valve not so ornamented; if so shaped, then one margin scobinate to apex . . . . .                                                                                                                                                                                | 4                             |
| 2 (1) | Basal half of dorsal margin of valve with a coarsely scobinate ridge. Digitate projection from aedeagus longer than width of aedeagus . . . . .                                                                                                                                  | <i>dasysceles</i> (p. 88)     |
| -     | Basal half of dorsal margin of valve weakly sclerotized, smooth or minutely scobinate. Projection from aedeagus shorter than width of aedeagus . . . . .                                                                                                                         | 3                             |
| 3 (2) | Fulcrum weakly sclerotized and straight, not extending to apex of aedeagus, which is blade-like apicad. Male hind femur short-scaled; hind tibia simple and short-scaled . . . . .                                                                                               | <i>incompta</i> (p. 100)      |
| -     | Fulcrum well sclerotized in apical half and curved dorsad over apex of aedeagus, which is digitate and finely tapered. Male hind femur fringed with long, buff hair-scales; hind tibia dilate and similarly scaled . . . . .                                                     | <i>setosa</i> (p. 101)        |
| 4 (1) | Valve weakly sclerotized; ventral and dorsal margins parallel; apex rounded; apical three-fourths of dorsal margin weakly but densely scobinate. Fulcrum longer than aedeagus, apex rounded; two large, asymmetrical, tapered projections at one-half . . . . .                  | <i>subinterrupta</i> (p. 103) |
| -     | Valve and fulcrum not so formed . . . . .                                                                                                                                                                                                                                        | 5                             |
| 5 (4) | Valve finely tapered apicad, apex straight or curved towards uncus; width of tip of valve similar to width of tip of uncus . . . . .                                                                                                                                             | 6                             |
| -     | Valve rounded or truncate at apex. Apex of dorsal margin sometimes with beak-like projection inclined towards uncus . . . . .                                                                                                                                                    | 11                            |
| 6 (5) | Valve curved through 90-120 degrees towards uncus in apical fourth . . . . .                                                                                                                                                                                                     | 7                             |
| -     | Valve not so formed . . . . .                                                                                                                                                                                                                                                    | 10                            |
| 7 (6) | Apex of valve acicular. Apex of fulcrum bifurcate . . . . .                                                                                                                                                                                                                      | 8                             |
| -     | Valve and fulcrum not so formed . . . . .                                                                                                                                                                                                                                        | 9                             |
| 8 (7) | Depth of cleft in apex of fulcrum equal to greatest width of fulcrum. Digitate projection from aedeagus smooth and tapered, equal in length to greatest                                                                                                                          |                               |

- width of aedeagus. Hyaline area of fore wing extending to termen between veins  $M_3$  and  $Cu_{1b}$  . . . . . *manifesta* (p. 93)
- Depth of cleft in apex of fulcrum equal to one-half of greatest width of fulcrum. Digitate projection from aedeagus scobinate and equal to one-half greatest width of aedeagus. Hyaline area of fore wing not extending to termen . . . . . *dargei* (p. 93)
- 9 (7) Apical three-fifths of dorsal margin of valve coarsely scobinate. Apex of aedeagus finely tapered. Fulcrum with irregularly crenulate lateral margins, tip not extending to apex of aedeagus. Vesica with hook-like cornutus . . . . . *lophobela* (p. 104)
- Dorsal margin of valve scobinate just below apex. Apex of aedeagus rounded. Fulcrum with smooth lateral margins, tip extending to or beyond apex of aedeagus. Vesica without cornutus . . . . . *melpomene* (p. 98)
- 10 (6) Apex of valve very narrowly rounded, equal in width to tip of uncus. Aedeagus with thorn-like projection at two-thirds. Male hind tibia dilate with pencil of long hair-scales. Distribution. C. & W. Africa . . . . . *sicula* (p. 92)
- Apex of valve acicular, appreciably narrower than tip of uncus. Aedeagus with blunt, spatulate projection at two-thirds. Male hind tibia simple. Distribution. Madagascar . . . . . *oxybeles* (p. 102)
- 11 (5) Apex of valve rounded or truncate, apical margin densely scobinate in part or entirely (20-60 + spines) . . . . . 12
- Apical margin of valve truncate, concave or convex, never with more than 5-10 small, weak, thorn-like projections; apex of dorsal margin produced, bluntly rounded or in beak-like form, inclined towards uncus and scobinate. 16
- 12 (11) Apex of valve narrowly rounded (Text-fig. 128). Fulcrum smooth-edged, as broad as aedeagus, but not extending to its tip. Uncus bulbous in shape. Male hind tibia grossly dilate with dense tuft of light buff hair-scales . . . . . *cinereata* (p. 91)
- Valve and fulcrum not so formed . . . . . 13
- 13 (12) Apical margin of valve broadly rounded, dorsal half coarsely scobinate; apical half of dorsal margin densely scobinate. Aedeagus with a short, almost rectangular projection at two-thirds. Male hind tibia dilate with a pencil of buff hair-scales . . . . . *dyscapna* (p. 89)
- Dorsal margin of valve strongly sclerotized, but not scobinate . . . . . 14
- 14 (13) Apex of valve obliquely truncate, apical margin densely scobinate (Text-fig. 118); dorsal process with slender, digitate, setose projection from basal fourth. Male hind tibia simple . . . . . *episema* (p. 87)
- Apex of valve horizontally truncate or curved; apical margin densely scobinate; dorsal process broadly dilate and setose in basal third. Male hind tibia dilate with dense pencil of hair-scales . . . . . 15
- 15 (14) Apex of valve horizontally truncate (Text-fig. 130). Aedeagus with smooth, digitate projection at one-half. Vesica without cornutus . . . . . *fusticula* (p. 91)
- Apical margin of valve curved. Aedeagus with scobinate, digitate projection at one-half. Vesica with thorn-like cornutus . . . . . *radula* (p. 90)
- 16 (11) Aedeagus with a thorn-like or short, blunt projection from apical third or fourth; when the projection is thorn-like, the fulcrum is asymmetrical, with a digitate projection midway along one side, and extends beyond tip of aedeagus. Dorsal process of valve dilate and setose in basal fourth . . . . . 17
- Aedeagus with a finely tapered blade-like projection or with one or more acicular projections from apical third or fourth, one projection usually equal in length to or longer than width of aedeagus; if shorter, then fulcrum slender, symmetrical and not extending beyond tip of aedeagus. Dorsal process of valve usually with distinct setose projection in basal fourth . . . . . 21
- 17 (16) Vesica with a thorn-like cornutus . . . . . 18



- Vesica without a cornutus . . . . . 19
- 18 (17) Apex of valve rounded. Aedeagus with digitate, apically rounded projection at two-thirds. Fulcrum slender with a pair of symmetrical, angular projections at one-half . . . . . *laciniata* (p. 88)
- Apex of valve truncate. Aedeagus with thorn-like projection at two-thirds. Fulcrum asymmetrical with digitate projection midway along one side . . . . . *thalia* (p. 96)
- 19 (17) Apex of dorsal margin of valve produced towards uncus, tip rounded with weakly scobinate margin. Aedeagus with a short, spatulate projection at two-thirds. Apex of fulcrum curved dorsad (Text-figs 139, 140). Male coxa with pocket of deciduous brownish grey scales on dorsal surface . . . . . *corymbophora* (p. 95)
- Apex of dorsal margin of valve produced towards uncus, tip tapered and scobinate on its basal surface. Male coxa not ornamented with specialized scales . . . . . 20
- 20 (19) Apex of ventral margin of valve rounded and simple. Projection from aedeagus spatulate with rounded apex, just subequal in length to greatest width of aedeagus (Text-figs 147, 148) . . . . . *penthesis* (p. 98)
- Apex of ventral margin of valve rounded and ridged, hence apical area scoop-like. Projection from aedeagus small and bicuspid (Text-figs 145, 146) . . . . . *astales* (p. 97)
- 21 (16) Aedeagus with two projections from two-thirds, both acicular or one acicular and one thorn-like . . . . . 22
- Aedeagus with one tapered, blade-like or one acicular projection from two-thirds . . . . . 24
- 22 (21) Both projections from aedeagus acicular, shorter projection longer ( $\times 4 - \times 5$ ) than cornutus. Fulcrum with a pair of angular projections at two-thirds (Text-figs 108, 109) . . . . . *pringlei* (p. 83)
- Both projections from aedeagus acicular, or one acicular and one thorn-like, the shorter projection shorter than cornutus. Fulcrum simple without angular projections . . . . . 23
- 23 (22) Apical third of dorsal margin of valve irregularly scobinate. Both projections from aedeagus usually acicular (Text-figs 112, 113), but shorter one sometimes thorn-like . . . . . *psectra* (p. 84)
- Apical fourth of dorsal margin of valve irregularly scobinate. Longer projection from aedeagus acicular, shorter always thorn-like (Text-figs 110, 111) . . . . . *dentata* (p. 83)
- 24 (21) Fulcrum with a pair of angular projections at two-thirds. Projection from one-half aedeagus tapered, flat and blade-like, one-third as long as aedeagus. Apex of ventral margin of valve acutely angled . . . . . *aclys* (p. 96)
- Fulcrum simple, without angular projections. Projection from two-thirds aedeagus acicular. Apex of ventral margin of valve rounded . . . . . 25
- 25 (24) Apex of valve smoothly rounded; short scobination of dorsal margin below level of apex (Text-fig. 137). Male hind tibia dilate with dense tuft of hair-scales . . . . . *hero* (p. 94)
- Apex of valve not smoothly rounded; scobinate part of dorsal margin level with or extending just beyond level of apex (Text-fig. 114). Male hind tibia simple . . . . . 26
- 26 (25) Acicular projection from aedeagus 1.75 times as long as greatest width of aedeagus. Distribution: Equatorial Africa . . . . . *excavata excavata* (p. 85)
- Acicular projection from aedeagus 0.8 times as long as greatest width of aedeagus. Distribution: Ethiopia . . . . . *excavata pollex* (p. 87)
- Acicular projection from aedeagus 1.25 times as long as greatest width of aedeagus. Distribution: Madagascar . . . . . *excavata acis* (p. 86)

*Zamarada pringlei* sp. n.

(Text-figs 108, 109; Pl. 25, figs 549, 550; Pl. 102, fig. 911)

♂ ♀ (Pl. 102, fig. 911). Head and vertex greyish yellow (pl. 4, B<sub>5</sub>, corn-colour); thorax and dorsum orange-grey (pl. 5, B<sub>2</sub>), the latter with a medial white spot on the first and a pale medial spot on each of the remaining segments. Hyaline area of each wing greyish yellow (pl. 2, B<sub>5</sub>) very finely edged distally with yellow, then with dark brown; costa and posterior margin of fore wing and posterior margin of hind wing orange-grey irrorate with brownish orange and black; discal spots black. Non-hyaline terminal area of each wing orange-grey edged proximally with a slender, darker band of brownish grey (pl. 7, C<sub>2</sub>); subterminal fascia a darker shade of brownish grey, dentate in discal area, slender between veins  $M_3$  and  $Cu_{1b}$ ; termen very slenderly black. Underside of non-hyaline terminal area of wings dark brown, except for pale greyish orange patches at apex of fore wing and at anal angle of hind wing; each wing slenderly pale along termen between veins  $M_3$  and  $Cu_{1b}$ . Male hind tibia simple.

♂ genitalia (Text-figs 108, 109). Valve truncate; dorsal margin sclerotized, apex produced, inclined towards uncus and scobinate; dorsal process with blunt, setose projection near base; coremata hairs light buff. Aedeagus acutely tapered apicad with two strongly sclerotized, acicular projections at two-thirds, one equal to, one subequal to greatest width of aedeagus. Fulcrum with a pair of angular projections at two-thirds, the apex not extending beyond tip of aedeagus. Vesica with a small, thorn-like cornutus.

♀ genitalia (Pl. 25, figs 549, 550). Sterigma with two digitate projections extending anteriorly, one at each side. Posterior half of corpus bursae strongly sclerotized, minutely scobinate at one side.

Measurements. Fore wing: ♂ 16 mm; ♀ 15–17 mm. Antennal pectinations: ♂ 13 ×, ♀ 4 × diameter of shaft.

Distinguished externally from closely related *dentata* Fletcher and *excavata* Bethune-Baker by the orange-grey colour of the non-hyaline terminal area of each wing. Distinguished structurally by the form of the valve, aedeagus and the ornamentation of the vesica in the male genitalia and by the form of the sterigma, with the two digitate projections extending anteriorly, and the extent of the sclerotization of the corpus bursae in the female genitalia.

DISTRIBUTION. Kenya, Tanzania, Rhodesia.

Holotype ♂, TANZANIA: E. Usambara, Amani, xi. 1965 (R. H. Carcasson), Geometridae genitalia slide no. 6882, in BMNH.

Paratypes. KENYA: Ngong, vi. 1945 (*van Someren*), 1 ♂; Mt. Meru, Kenya distr., 5600 ft, xi. 1920 (*W. N. van Someren*) 1 ♀. TANZANIA: holotype data, 1 ♀; ibidem, ii. 1928 (*C.B.W.*), 1 ♀; ii. 1953 (*E. Pinhey*), 2 ♂, 1 ♀; Amani, iii, vii, ix, xi (*G. Pringle*), 11 ♀; ibidem, iv. 1952 (*C. Howard*), 1 ♀ (all BMNH); Amani, 21–30.iv.1969 (*Watulege*), 4 ♂ (coll. Herbulot, Paris). RHODESIA: Mt Selinda, Nyamadzi River, iv. 1956, 1 ♀ (BMNH).

*Zamarada dentata* Fletcher

(Text-figs 110, 111; Pl. 102, fig. 914)

*Zamarada dentata* Fletcher, 1958 : 141, figs 55, 80, 220. Holotype ♂, UGANDA (BMNH) [examined].

*Zamarada dentata* Fletcher; Fletcher, 1963 : 33.

♂ (Pl. 102, fig. 914). Vestiture and wing pattern similar to those of *pringlei*, but wings suffused with brown and brownish grey distad of the subterminal fascia. Male hind tibia simple.

♂ genitalia (Text-figs 110, 111). Ventral margin of valve curved apicad; dorsal margin slenderly sclerotized and irregularly scobinate in apical fourth; dorsal process dilate and setose at one-fourth; hair-scales of coremata light buff. Aedeagus with a strongly sclerotized, acicular projection extending almost to its tip and a short, thorn-like projection, both arising at three-fourths. Fulcrum with a spine-like tip. Vesica with a tapered cornutus, one-half as long as greatest width of aedeagus.

♀ unknown.

Measurements. Fore wing: ♂ 16 mm. Antennal pectinations: ♂ 14 × diameter of shaft.

The extent of the irregular scobination along the apical part of the dorsal margin of the valve and the form of the projections on the aedeagus are specifically diagnostic.

DISTRIBUTION. S.W. Uganda, Rwanda, Zaire.

#### MATERIAL EXAMINED.

Holotype ♂, UGANDA; Ruwenzori, Bwamba Pass (west side), 5500–7500 ft, xii. 1934–i. 1935 (*F. W. Edwards*), Geometridae genitalia slide no. 3304, in BMNH.

UGANDA: Kigezi, Mafuga Rain Forest, 7500–8000 ft, vi. 1961 (*T. H. E. Jackson*), 1 ♂; Kigezi, Kayonza, iii. 1967 (*R. C. Otieno*), 1 ♂ (NMK, Nairobi); Kigezi, Impenetrable Forest, iii. 1967 (*R. C. Otieno*), 1 ♂ (BMNH). RWANDA: Kabira Forest, 12 miles N. of Usumbura, 7000 ft, ii. 1924 (*T. A. Barns*), 1 ♂. ZAIRE ('Belgian Congo'): Kalonge, 2210 m, 25–27.vii.1952, 1 ♂ (MRHN, Brussels).

### *Zamarada psectra* sp. n.

(Text-figs 112, 113; Pl. 25, figs 551, 552)

♂ genitalia (Text-figs 112, 113). Dorsal margin of valve slenderly sclerotized, apical third irregularly scobinate, tip produced towards uncus; in some examples the scobinate area extends to one-half dorsal margin; dorsal process as in *dentata*; coremata hair-scales light buff. Aedeagus with a strongly sclerotized, acicular projection extending beyond its tip and a second, one-half as long as the first, arising at three-fourths. Fulcrum with strongly sclerotized spine-like apex. Vesica with a tapered cornutus equal in length to greatest width of aedeagus.

♀ genitalia (Pl. 25, figs 551, 552). Sterigma with two digitate processes extending anteriorly, one at each side, the longer extending into the corpus bursae the posterior two-ninths of which are sclerotized.

Measurements. Fore wing: ♂ 15–17 mm; ♀ 15 mm. Antennal pectinations: ♂ 15 ×, ♀ 8 × diameter of shaft.

Externally closely similar to *dentata*, which it appears to represent in the forests of eastern Africa. Distinguished from it in the male genitalia by the more extensive scobination of the dorsal margin of the valve, by the longer, acicular projections from the aedeagus and by the longer cornutus on the vesica. The male hind tibia is simple. The female of *dentata* is unknown.

DISTRIBUTION. Kenya, Tanzania, Mozambique, Rhodesia.

Holotype ♂, TANZANIA: Amani, v. 1963 (*G. Pringle*), Geometridae genitalia slide no. 7047, in BMNH.

Paratypes. KENYA: Northern Frontier District, Marsabit, 4500 ft, ii. 1956 (*J. G. Williams*), 1 ♂. TANZANIA: Amani (*G. Pringle*), 1 ♀ (both BMNH); Mt. Meru, Momella, 1600–1800 m, 1–10.ii.1964 (*W. Forster*), 1 ♂ (ZSBS, Munich); Oldieni, iv. 1961 (*J. Kielland*), 1 ♂ (BMNH). MOZAMBIQUE: 40 miles S.E. of Inhalinga, 18.viii.1971 (*E. Pinhey*), 1 ♀; Chiluvo Hills, 2.xi.1963, 1 ♂; Serra Rotanda, E. of Chimanimani Mts., 3–8.iii.1970 (*E. Pinhey*), 5 ♂, 1 ♀. RHODESIA: Vumba Mts., i. 1958, 1 ♂; ibidem, 1.iv.1963, 1 ♂ (all NMR, Bulawayo).

### *Zamarada excavata* Bethune-Baker

(Text-figs 114–117; Pl. 26, figs 553–556; Pl. 102, fig. 913)

*Zamarada excavata* Bethune-Baker, 1913 : 573.

♂ ♀ (Pl. 102, fig. 913). Colour and pattern of vestiture and wings similar to those of *dentata* and *psectra*, but differing on the upperside in the suffusion of the non-hyaline terminal area of each wing with greyish ruby (pl. 12, D4), densely and evenly in the female, to a lesser extent in the male; subterminal fascia rarely marked, then with brownish yellow (pl. 5, C7) interneural spots except between veins  $M_3$  and  $Cu_{1b}$ . Male hind tibia simple.

♂ genitalia (Text-figs 114–117). Dorsal margin of valve sclerotized, apex of margin produced towards uncus and scobinate; dorsal process with a broad, setose projection from basal fourth; hair-scales of coremata light buff. Aedeagus with a strongly sclerotized, acicular projection arising at two-thirds, varying in length geographically. Fulcrum weakly sclerotized and simple, not extending to tip of aedeagus. Vesica with a thorn-like cornutus, two-fifths as long as greatest width of aedeagus.

♀ genitalia (Pl. 26, figs 553–556). Sterigma with a digitate process extending anteriorly, the extent varying geographically. Posterior third of corpus bursae sclerotized.

Measurements. Fore wing: ♂ 12–15 mm; ♀ 13–16 mm. Antennal pectinations: ♂ 11 ×, ♀ 6 × diameter of shaft.

DISTRIBUTION. C. & W. Africa, Ethiopia, Tanzania, Madagascar.

Three subspecies are recognized, characterized by the structure of the aedeagus.

### *Zamarada excavata excavata* Bethune-Baker

(Text-figs 114, 115; Pl. 26, figs 553, 554; Pl. 102, fig. 913)

*Zamarada excavata* Bethune-Baker, 1913 : 573. Holotype ♂, ANGOLA (BMNH) [examined].

*Zamarada excavata* Bethune-Baker; Fletcher, 1958a : 142.

Distinguished by the length of the acicular projection arising at two-thirds aedeagus, which is 1.75 times as long as the greatest width of the aedeagus.

The underside of the non-hyaline area of the fore wing is greyish brown, except for a pale greyish orange apical patch; the non-hyaline area of the hind wing is greyish orange, the proximal half suffused with greyish brown between apex and vein  $M_3$ .

DISTRIBUTION. Angola, Cameroun, Nigeria, Guinea, Central African Republic, Zaire, Uganda, W. Kenya, Tanzania, Zambia, Malawi.



## MATERIAL EXAMINED.

*Zamarada excavata* Bethune-Baker, holotype ♂, ANGOLA: north, N'Dalla Tando, 2700 ft, 19.xi.1908 (*Dr W. J. Ansorge*), Geometridae genitalia slide no. 1679, in BMNH.

ANGOLA: Malange distr., Matete, 27.xi.1957 (*Gerd Heinrich*), 1 ♂ (ZSBS, Munich); Quirimbo, 75 km E. of Amboim, 300 m, 7-12.v.1934 (*Dr K. Jordan*), 3 ♂, 1 ♀; Amboim district, Fazenda Congulu, 700-800 m, 7-16.iv.1934 (*Dr K. Jordan*), 3 ♂, 2 ♀; Pungo Andongo, iv. 1875 (*A. v. Homeyer*), 2 ♂; holotype locality, 16.xi.1908, 1 ♂ (all BMNH). CAMEROUN: Bitje, Ja River, x-xi, 3 ♂ (BMNH); Efulen, i, vi, ix-xii (*H. L. Weber*), 7 ♂, 2 ♀ (CM, Pittsburgh). NIGERIA: Ashanti, Juaso (*G. H. Gibbs*), 1 ♀ (BMNH). GUINEA: Nimba, vii-xii. 1951 (*Lamotte & Roy*), 3 ♂ (MNHN, Paris). CENTRAL AFRICAN REPUBLIC: Bangui, 1 ♂ (BMNH). ZAIRE ('Belgian Congo'): Lubudi, ii. 1960, 1 ♂ (BMNH), 1 ♂ (NMR, Bulawayo); Elisabethville, 5.iii.1952 (*C. Seydel*), 1 ♂; ibidem, 15.iv.1952, 1 ♂ (both BMNH). UGANDA: Bwamba, ii-iii. 1957 (*R. H. Carcasson*), 1 ♂; Fort Portal, Mpanga Forest, ii. 1957 (*R. H. Carcasson*), 1 ♂; Entebbe, iii. 1961 (*N. Mitton*), 1 ♂; Kampala, Kabanyolo Farm, viii. 1965 (*W. Block*), 1 ♂; Jinja, Mabira Forest, x. 1962 (*R. H. Carcasson*), 1 ♂ (all NMK, Nairobi); Kawanda Research Station, i, xi, xii (*D. N. McNutt*), 10 ♂, 2 ♀ (BMNH). KENYA: west, Kakamega, iii. 1966 (*R. H. Carcasson*), 1 ♂ (NMK, Nairobi); Elgeyo Escarpment, Marakwet, 2500 m, 1 ♀ (MNHN, Paris); Mt. Elgon, ii-iii. 1957 (*T. H. E. Jackson*), 1 ♀ (BMNH). TANZANIA: Mt. Meru, Momella, 1600-1800 m, 1-10.ii.1964 (*W. Forster*), 6 ♂, 10 ♀ (ZSBS, Munich); E. Usambara, Amani, xi. 1965 (*R. H. Carcasson*), 1 ♂ (NMK, Nairobi); Kigonsera, 1 ♂ (BMNH), 1 ♂ (ZSBS, Munich); ibidem, ii. 1960 (*Pater O. Morger*), 1 ♂ (ZSBS, Munich); Tukuyu Dist., Massoko, 26.vii.1924 (*N. C. E. Miller*), 1 ♂ (BMNH); Marangu, 1500 m, 18.x.1952, 1 ♀ (ZSBS, Munich). ZAMBIA: Ndola, v. 1968, 1 ♂ (NMR, Bulawayo). MALAWI: Ruw Valley, 1000 ft, 12.vii.1913, 1 ♂, 1 ♀; Mlanje, 2300 ft, 16.vii.1913, 1 ♂; Mlanji Boma, 2400 ft, 27.iv.1913, 1 ♂; Mt. Mlanje, 30.x.1913, 1 ♀ (all *S. A. Neave*); Zomba Plateau, vi. 1920 (*H. Barlow*), 1 ♂ (all BMNH); Zomba, 15.v.1955, 1 ♂ (NMR, Bulawayo).

*Zamarada excavata acis* subsp. n.

(Text-fig. 116; Pl. 26, figs 555, 556)

Distinguished by the shorter length of the acicular projection from the aedeagus, which is 1.25 times as long as the greatest width of the aedeagus.

In the female genitalia the digitate process from the sterigma is reduced in length, extending only just into the posterior fourth of the sclerotized part of the corpus bursae.

On the upperside of the wings, the subterminal fascia is darker and more heavily marked than in the nominate subspecies. In some examples the remainder of the non-hyaline terminal area is suffused with dark grey. The underside of the non-hyaline terminal area is uniformly dark grey, except for the slightly paler apical area in the fore wing of the male.

DISTRIBUTION. N. & E. Madagascar.

Holotype ♂, MADAGASCAR: Ambinanindrano, 50 km W. of Mahanoro, v. 1912 (*G. K. Kestell-Cornish*), Geometridae genitalia slide no. 7044, in BMNH.

Paratypes. MADAGASCAR: holotype locality, ii. 1913, 1 ♀; iv. 1912, 3 ♀ (all BMNH); Marojejy, res. nat. int. XII, Anjanaharibe S., 1600 m, iv. 1960 (*P. Soga*), 2 ♂ (MNHN, Paris); Diego Suarez, ii-iv. 1917 (*G. Melou*), 1 ♂; ibidem, 24.vii.1917, 1 ♂ (both BMNH); Diego Suarez, 1893 (*C. Alluaud*), 1 ♂ (MNHN, Paris).

### *Zamarada excavata pollex* subsp. n.

(Text-fig. 117)

Distinguished by the short length of the acicular projection arising from two-thirds aedeagus, which is 0.8 as long as the greatest width of the aedeagus.

In the female genitalia the process from the sterigma is similar to that of subsp. *acis*.

The non-hyaline terminal areas of the wings of both sexes are evenly suffused with greyish ruby, as in the female of the nominate subspecies. The underside of the non-hyaline terminal area is similar to that of the nominate subspecies.

DISTRIBUTION. Ethiopia.

Holotype ♂, ETHIOPIA: JIubador Gore (8°8' N. 35°31' E.), 2007 m, 8-23.xii.1959 (*Richter*), in SMN, Stuttgart.

Paratypes. ETHIOPIA: holotype data, 4 ♂; Jimma, 7°39' N. 36°49' E., 1779 m, 29.i.1960 (*Richter*), 2 ♂ (all SMN, Stuttgart); Wolamo Prov., Soddu, c. 6800 ft, 4.xi.1948 (*Hugh Scott*), 1 ♀ (BMNH); Lalokeli, 4.xi.1926, 1 ♂; Saupé Boro, 25.v.1925, 1 ♂ (both MNHN, Paris).

### *Zamarada episema* sp. n.

(Text-figs 118, 119; Pl. 27, figs 557, 558; Pl. 102, fig. 912)

♂ ♀ (P. 102, fig. 912). Hyaline area of each wing greyish green slenderly edged distally with brown; costa of fore wing light buff irrorate with brown; posterior margin of each wing sparsely striate with brown; discal spots black, minute. Non-hyaline terminal area bounded proximally by a strongly marked, slender reddish grey band, the distal margin of which is fused with the subterminal fascia, marked as reddish orange tooth-like projections anterior of vein  $M_3$  and posterior of vein  $Cu_{1b}$ ; remainder of non-hyaline terminal area light buff irrorate with reddish grey, except at tornus of fore wing and at anal angle of hind wing, these areas remaining clear buff. Underside of non-hyaline terminal area brown, darker proximally; apical and tornal areas of fore wing and anal area of hind wing buff.

Male hind tibia simple.

♂ genitalia (Text-figs 118, 119). Valve obliquely truncate, apical margin coarsely spined; dorsal margin sclerotized; dorsal process with slender, digitate, setose projection at one-fourth; hair-scales of coremata greyish yellow. Aedeagus with a sclerotized projection, dilate in apical half then tapered to tip, at two-thirds. Fulcrum with a pair of angular projections at five-eighths. Vesica with a thorn-like cornutus.

♀ genitalia (Pl. 27, figs 557, 558). Sterigma with a digitate process extending anteriorly. Posterior half of corpus bursae sclerotized.

Measurements. Fore wing: ♂ 12-13 mm; ♀ 13 mm. Antennal pectinations: ♂ 8 ×, ♀ 6 × diameter of shaft.

Distinguished externally from the preceding species by wing colour, by the darker green of the hyaline area and by the conspicuously pale non-hyaline terminal area with its clear buff tornal and anal spots. In the male genitalia the form of the valve and of the aedeagus and in the female genitalia the form of the sterigma and extent of the sclerotization of the corpus bursae are diagnostic.

DISTRIBUTION. Nigeria, Cameroun, Zaire, Gabon.

Holotype ♂, CAMEROUN ('Kamerun'): Efulen, 9.iv.1923 (*H. L. Weber*), in CM, Pittsburgh.

Paratypes. NIGERIA: Warri, vi. 1897 (*Dr Roth*), 1 ♂ (BMNH). CAMEROUN: N'Kongsamba, 18.vi.1958 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris); Efulen (*Good*), 1 ♀ (CM, Pittsburgh). GABON: Savanes de Mwadi, près du Iézé, 1.iv.1963, 1 ♂; Belinga, 900 m, 19.iii.1963, 1 ♂; Makokou, Colline Mission biologique, 11.xi.1967, 1 ♀; ibidem, 6.xii.1967, 1 ♂ (all *G. Bernardi*, in MBG, Paris). ZAIRE ('Belgian Congo'): Sankaru, Bena Dibele, iv. 1959 (*R. H. Carcasson*), 1 ♂ (BMNH); Lusambo, 27.viii.1949 (*Dr M. Fontaine*), 1 ♂ (MRAC, Tervuren).

### *Zamarada dasysceles* sp. n.

(Text-figs 120, 121; Pl. 103, fig. 919)

♂ (Pl. 103, fig. 919). Hind leg: femur fringed with, tibia dilate and bearing a dense tuft of long, yellow hair-scales.

♂ genitalia (Text-figs 120, 121). Uncus shorter and apex less sharply tapered than in *episema*. Apex of valve membranous and narrowly rounded; dorsal margin with strongly sclerotized and scobinate ridge in basal half; hair-scales of coremata black. Aedeagus and vesica similar to those of *episema*, but digitate projection from aedeagus of even width to rounded apex. Fulcrum with only one angular projection.

♀ unknown.

Measurements. Fore wing: ♂ 16 mm. Antennal pectinations: ♂ 10 × diameter of shaft.

Closely similar in colour and pattern to *episema*, with which it evidently occurs at Lusambo; distinguished externally by its greater wing length, by the extension of the green hyaline area to the termen of each wing between veins  $M_3$  and  $Cu_{1b}$  and in the male by the fringed hind femur and by the dilate and tufted hind tibia. Distinguished in the male genitalia by the form of the valve and of the aedeagus.

DISTRIBUTION. Zaire.

Holotype ♂, ZAIRE ('Belgian Congo'): Lusambo, 11.x.1950 (*Dr M. Fontaine*) in MRAC, Tervuren.

Paratypes. ZAIRE ('Belgian Congo'): Lusambo, 17.vii.1949 (*Dr M. Fontaine*), 1 ♂; Sankaru, Luluabourg, 6.v. 1951 (*Dr M. Fontaine*), 1 ♂ (both MRAC, Tervuren).

### *Zamarada laciniata* sp. n.

(Text-figs 122, 123; Pl. 27, figs 559, 560; Pl. 103, fig. 918)

♂ ♀ (Pl. 103, fig. 918). Hyaline area of wings dull greyish yellow to olive-brown; costa of fore wing and discal spots grey; non-hyaline terminal area and posterior margin of each wing

light orange irrorate and suffused with brown, more densely on hind wing; broken, dentate subterminal fascia cinnamon brown. Underside. Fore wing of male and both fore and hind wings of female: apical and tornal areas light orange; remainder of non-hyaline area dark brown suffused with cinnamon-brown proximally, bordering hyaline area; male hind wing with fringe of greyish yellow hair-scales along anal margin and a dense patch of grey hair-scales in submedial fold.

Male hind leg: coxa dilate enclosing pocket of short, light brown scales; femur fringed with long, light buff hair-scales; tibia grossly dilate, medially one-half as broad as long, with a pocket of long, light buff hair-scales.

♂ genitalia (Text-figs 122, 123). Apex of valve rounded; dorsal margin scobinate and at three-fifths produced in angular form. Aedeagus with an apically rounded, spatulate, digitate projection at two-thirds. Fulcrum with a pair of angular projections at one-half; apical half slender and smooth and extending beyond tip of aedeagus. Vesica with a stout, thorn-like cornutus.

♀ genitalia (Pl. 27, figs 559, 560). Posterior third of corpus bursae sclerotized, very strongly at right-hand side.

Measurements. Fore wing: ♂ 16.5–18.0 mm; ♀ 15.5 mm. Antennal pectinations: ♂ 12 ×, ♀ 6 × diameter of shaft.

Distinct in colour and wing pattern of both sexes and in the male in the specialized underside of the hind wing and specialized hind leg. In the male genitalia the form of the valve and of the aedeagus and in the female the form of the sterigma and extent of the sclerotization of the corpus bursae are diagnostic.

DISTRIBUTION. Gabon.

Holotype ♂, GABON: Belinga, Camp Central, 500 m, 22.iii.1963 (*G. Bernardi*), in MBG, Paris.

Paratypes. GABON: Belinga, Camp Central, 500 m, 22.iii.1963, 1 ♂; Belinga, Camp Central, 700 m, 11.iii.1963, 1 ♀; Belinga, Savane ter. aviation, 12.iii.1963, 1 ♂; rive droite du Iézé, N. de Mwadi, 5.iv.1963, 1 ♀ (all *G. Bernardi*) (MBG, Paris).

### *Zamarada dyscapna* sp. n.

(Text-figs 124, 125; Pl. 28, figs 561, 562; Pl. 102, fig. 915)

♂ ♀ (Pl. 102, fig. 915). Hyaline area of each wing greyish green, slenderly edged distally with brown; discal spots black, minute. Non-hyaline terminal area grey, darker proximally; subterminal fascia reddish orange, edged distally with silvery white, interrupted by the intrusion of the hyaline area between veins  $M_3$  and  $Cu_{1b}$ . Underside of non-hyaline terminal area uniformly dark brown.

Male hind leg: femur fringed with long, pale hair-scales; tibia slightly dilate, inner surface bearing long, light buff hair-scales, densely tufted near joint with femur.

♂ genitalia (Text-figs 124, 125). Valve rounded at apex; dorsal margin sclerotized; dorsal half of apical margin and apical half of dorsal margin coarsely spined; dorsal process slightly dilate and setose at one-third. Aedeagus with a short, almost rectangular projection at two-thirds. Fulcrum with a pair of angular projections at two-thirds. Vesica with a thorn-like cornutus and a small scobinate area.

♀ genitalia (Pl. 28, figs 561, 562). Sterigma with a very short, digitate projection at left side, shaped as in figure. Posterior fourth of corpus bursae sclerotized.

Measurements. Fore wing: ♂ 12–14 mm; ♀ 12.0–13.5 mm. Antennal pectinations: ♂ 8 ×, ♀ 5 × diameter of shaft.



Distinguished externally in both sexes by the tone of the green hyaline area and by the almost uniformly grey, non-hyaline area and in the male by the specialized scaling on the hind leg. In the male genitalia the form of the valve and of the aedeagus and in the female genitalia the form of the sterigma are diagnostic.

DISTRIBUTION. Guinea, Liberia, Ivory Coast, Ghana, Cameroun, Zaire, Gabon, Angola.

Holotype ♂, LIBERIA: Nimba, Grassfield, vii-viii. 1967 (*A. Forbes-Watson*), Geometridae genitalia slide no. 6877, in BMNH.

Paratypes. GUINEA: Beyla (*Dr Mir. Mrázek*), 1 ♀ (MM, Brno). IVORY COAST: Bingerville, 1-5.viii.1915 (*G. Melou*), 1 ♂; ibidem, 1915, 1 ♀. GHANA: Kumasi (Coomassie), ii-iii. 1923 (*N. E. Bell*), 1 ♀ (all BMNH). CAMEROUN: Efulen, 20.xi.1925 (*H. L. Weber*), 1 ♂ (CM, Pittsburgh). GABON: Belinga, 800 m, Piste de Mwadi, 20.iii.1963 (*G. Bernardi*), 1 ♂ (MBG, Paris). ZAIRE ('Belgian Congo'): Matadi, 1931 (*A. Dumez*), 1 ♂ (MNHN, Paris). ANGOLA: Quiculungo, 120 km N. of Lucala, 800 m, iv. 1936 (*R. Braun*), 1 ♂ (BMNH).

### *Zamarada radula* sp. n.

(Text-figs 126, 127; Pl. 28, figs 563, 564; Pl. 102, figs 916, 917)

♂ ♀ (Pl. 102, figs 916, 917). Closely similar in wing colour and pattern to *dyscapna*, differing in the rather darker green (pl. 29, B5) hyaline area and the brownish orange rather than grey non-hyaline terminal area.

Distinguished further externally by the denser, darker tufting of the male hind tibia. The femur is edged on its inner surface with long, light buff hair-scales; the tibia is dilate with a dense tuft of greyish brown and light buff hair-scales.

♂ genitalia (Text-figs 126, 127). Apex of valve broadly curved and coarsely scobinate; dorsal margin sclerotized; dorsal process dilate and setose near base; hair-scales of coremata black. Aedeagus with a scobinate, digitate projection at one-half. Fulcrum spatulate and slightly spiral in apical half. Vesica with a small, thorn-like cornutus.

♀ genitalia (Pl. 28, figs 563, 564). Sterigma with a long, slender, digitate process extending anteriorly to anterior edge of sclerotized posterior third of corpus bursae.

Measurements. Fore wing: ♂ 14-15 mm; ♀ 14 mm. Antennal pectinations: ♂ 10 ×, ♀ 5 × diameter of shaft.

DISTRIBUTION. Uganda, Zaire, Gabon.

Holotype ♂, UGANDA: Masaka, Katera, Sango Bay, x. 1960 (*R. H. Carcasson*), Geometridae genitalia slide no. 6879, in BMNH.

Paratypes. UGANDA: holotype data, 1 ♀; Ankole, Kalinzu Forest, xi. 1961 (*R. H. Carcasson*), 1 ♂; Kawanda Research Station, 30.xi.1969 (*D. N. McNutt*), 1 ♂ (all BMNH). ZAIRE ('Belgian Congo'): Sankaru, Kasai, Bena Dibele, iv. 1959 (*R. H. Carcasson*), 1 ♂ (NMK, Nairobi); Lusambo 26-27.vi.1949 (*Dr M. Fontaine*), 2 ♂; ibidem, 8.ix.1950, 1 ♂ (all MRAC, Tervuren). GABON: Franceville, 15-20.ix.1963 (*P. Darge*), 2 ♂; ibidem, 10.x.1963, 1 ♂; ibidem, 15-20.xi.1963, 2 ♂ (all coll. Herbulot, Paris); Belinga, Camp Central, 500 m, 25.iii.1963 (*G. Bernardi*), 1 ♂ (MBG, Paris).

*Zamarada cinereata* sp. n.

(Text-figs 128, 129; Pl. 29, figs 565, 566; Pl. 103, fig. 922)

♂ ♀ (Pl. 103, fig. 922). Hyaline area green-tinged, finely edged distally with yellow and dark brown and very sparsely striate with grey; costa of fore wing and posterior margin of each wing buff, striate with grey; discal spots dark grey, minute. Non-hyaline terminal area brownish grey to brownish orange (pl. 5, C2-C3); dentate subterminal fascia dark brown (pl. 5, E6-F6), much broken and finely edged distally with silvery grey; cilia chequered buff and grey. Underside of non-hyaline terminal area uniformly greyish brown.

Male hind femur fringed with long, light buff hair-scales; tibia grossly dilate with dense tuft of light buff hair-scales.

♂ genitalia (Text-figs 128, 129). Uncus short and bulbous. Valve short for size of moth; apex narrowly rounded and densely scobinate; a triangular, spatulate projection at base of dorsal margin; dorsal process similar to that of *radula*; hair-scales of coremata dark grey. Aedeagus with a short, strongly sclerotized, tapered, digitate projection in apical fourth. Fulcrum tapered apicad, subequal in length to aedeagus. Vesica with a thorn-like cornutus.

♀ genitalia (Pl. 29, figs 565, 566). Sterigma wrinkled anteriorly; anterior margin produced and tapered medially; posterior margin of lamella antevaginalis broadly U-shaped; lamella postvaginalis with an apically rounded, medial projection.

Measurements. Fore wing: ♂ 18 mm; ♀ 15 mm. Antennal pectinations: ♂ 6 ×, ♀ 4 × diameter of shaft.

Distinguished externally from *radula* and *fusticula* in the shape of the hyaline area of each wing and in its conspicuous, very slender yellow terminal margin; distinguished further in the male by the shorter antennal pectinations. In the genitalia the form of the uncus, valve and aedeagus in the male and that of the sterigma in the female are diagnostic.

DISTRIBUTION. Gabon, Zaire.

Holotype ♂, GABON: Savanes de Mwadi, près du Iézé, 26.iii.1963 (*G. Bernardi*), in MBG, Paris.

Paratypes. GABON: Makokou, Colline Mission biologique, 28.x.1967 (*G. Bernardi*), 1 ♂ (MBG, Paris). ZAIRE ('Belgian Congo'): Kinshasa (Leopoldville), 5.iv.1953 (*P. Jobels*), 1 ♀ (MRAC, Tervuren).

*Zamarada fusticula* sp. n.

(Text-figs 130, 131; Pl. 103, fig. 921)

♂ (Pl. 103, fig. 921). Very closely similar in colour and pattern to *hero* Prout, but differing in the uniformly dark brown underside of the non-hyaline terminal area.

Male hind leg similar in ornamentation to that of *hero*.

♂ genitalia (Text-figs 130, 131). Distinguished from the closely related *radula* by the horizontally truncate, not curved, apex of the valve and its scobinate apical margin and by the form of the aedeagus, in which the projection is smooth and slender, not scobinate; the fulcrum is slender and not spiral as in *radula* and the vesica is without a cornutus. The hair-scales of the coremata are dark grey.

♀ unknown.

Measurements. Fore wing: ♂ 14.5 mm. Antennal pectinations: ♂ 9 × diameter of shaft.

DISTRIBUTION. Cameroun.

Holotype ♂, CAMEROUN ('Afriq. Occid.'): Station Kamerun, Johann-Albrechts Höhe, 1898 (*L. Conradt*), Geometridae genitalia slide no. 6876, in BMNH.

Paratype. 1 ♂ with holotype data.

### *Zamarada sicula* sp. n.

(Text-figs 132, 133; Pl. 29, figs 567, 568; Pl. 103, fig. 920)

♂ ♀ (Pl. 103, fig. 920). Colour and pattern of upperside of wings similar to those of *excavata*, but differing in the shallower hyaline excavation of the terminal area of each wing. Underside of non-hyaline terminal area of each wing dark brown, apical area of fore wing light buff.

Male hind tibia slightly dilate with a tuft of long light buff hair scales on inner surface, near joint with femur. In *excavata* the male hind tibia is simple.

♂ genitalia (Text-figs 132, 133). Valve finely tapered, apex narrowly rounded and scobinate; dorsal margin sclerotized; dorsal process with a digitate, setose projection at one-fifth; hair-scales of coremata light buff. Aedeagus with a strongly sclerotized, thorn-like projection at two-thirds. Fulcrum with a pair of angular projections, varyingly developed, just beyond one-half. Vesica with a short, stout, tapered cornutus.

♀ genitalia (Pl. 29, figs 567, 568). Sterigma slightly asymmetrical, with a short, broad, digitate process extending anteriorly. Posterior third of corpus bursae sclerotized.

In the male genitalia the form of the valve and of the aedeagus and in the female genitalia the form of the sterigma are diagnostic.

Measurements. Fore wing: ♂ ♀ 13.5–14.0 mm. Antennal pectinations: ♂ 10 ×, ♀ 8 × diameter of shaft.

DISTRIBUTION. Sierra Leone, Ivory Coast, Nigeria, Cameroun, Gabon, Zaire, Uganda.

Holotype ♂, UGANDA: Toro, Bwamba, ix. 1961 (*N. Mitton*), Geometridae genitalia slide no. 6874, in BMNH.

Paratypes. SIERRA LEONE: Bo, vi. 1969 (*R. Revell*), 2 ♂. IVORY COAST: Bingerville, 8–11.ix.1915 (*G. Melou*), 1 ♀. NIGERIA: Niger, 1 ♀; Warri, iv–v. 1897 (*Dr Roth*), 2 ♂; Degama, Niger (*Dr Ansorge*), 1 ♂ (all BMNH). CAMEROUN: Efulen, 15.iii.1923 (*H. L. Weber*), 1 ♀; ibidem, 9.vi.1913, 1 ♂; Duala, 9.viii.1926 (*A. Good*), 1 ♂ (all CM, Pittsburgh); M'Balmayo, Ecole forestière, 11.ix.1971 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris); Lolodorf, 1894–1895 (*L. Conradt*), 1 ♂ (BMNH). GABON: Savanes Mwadi, près du Iézé, 1.iv.1963, 1 ♂; Belinga, Camp Central, 700 m., 14.iii.1963, 1 ♂; ibidem, 14.v.1963, 1 ♂ (all *G. Bernardi*) (all MBG, Paris). ZAIRE (Belgian Congo): Kindu, 10.iii.1926, 1 ♀; Equateur, Bokote, 1927 (*Hulstaert*), 1 ♀ (both BMNH); Lulonga, 9.x.1913 (*L. Burgeon*), 1 ♂ (MRAC, Tervuren). UGANDA: holotype data, 1 ♂ (NMK, Nairobi), 1 ♀ (BMNH), Bwamba, ii–iii. 1957 (*R. H. Carcasson*), 1 ♂ (BMNH).

*Zamarada manifesta* sp. n.

(Text-figs 134, 135; Pl. 30, figs 569, 570; Pl. 103, fig. 924)

♂♀ (Pl. 103, fig. 924). Hyaline area of wings tinged with yellowish green, extending narrowly almost to termen between veins  $Cu_{1a}$  and  $Cu_{1b}$  on fore wing, reduced to a small dark brown-edged area in proximal fourth of hind wing; discal spot on fore wing dark grey. Non-hyaline terminal area of wings light brown (pl. 5, B4, greyish orange) irrorate and edged, as illustrated, with dark brown (pl. 5, E4, brown). Underside of non-hyaline area greyish brown, except distal third of apical area of fore wing, which is light brown.

Male hind tibia dilate, bearing a tuft of long, light buff hair-scales.

♂ genitalia (Text-figs 134, 135). Apex of valve acicular, incurved through 90 degrees towards uncus; apical fourth of dorsal margin scobinate, base of dorsal margin with spatulate projection; dorsal process with short, setose projection in basal third. Aedeagus with two tapered projections from apical third, one equal in length to greatest width of aedeagus, one short and thorn-like. Fulcrum sinuous, apex strongly sclerotized and bifurcate, the cleft equal in depth to the greatest width of the fulcrum.

♀ genitalia (Pl. 30, figs 569, 570). Sterigma asymmetrical, right-hand side of lamella antevaginalis rounded and scobinate posteriorly.

Measurements. Fore wing: ♂ 14–15 mm; ♀ 14 mm. Antennal pectinations: ♂ 9 ×, ♀ 6 × diameter of shaft.

Strikingly distinct in wing pattern. Structurally the form of the finely tapered valve, the depth of the cleft in the strongly sclerotized fulcrum and the size and form of the projections from the aedeagus in the male genitalia and the form of the asymmetrical sterigma in the female genitalia are diagnostic.

DISTRIBUTION. Gabon.

Holotype ♂, GABON: Savanes Mwadi, près du Iézé, 26.iii.1963 (G. Bernardi), in MBG, Paris.

Paratypes. GABON: Savanes Mwadi, près du Iézé, 26.iii.1963 (G. Bernardi), 1 ♀; ibidem, 1.iv.1963, 1 ♂ (both MBG, Paris).

*Zamarada dargei* sp. n.

(Text-fig. 136; Pl. 103, fig. 925)

♂ (Pl. 103, fig. 925). Similar in colour and pattern to *manifesta*, but distinguished by the more extensive hyaline area on the hind wing and the less extensive distal penetration of the hyaline area on the fore wing. On the hind wing the ratio of hyaline to non-hyaline is 7 : 9; in *manifesta* that ratio is 5 : 9. On the fore wing the hyaline does not penetrate to the termen as it does in *manifesta*.

The hind tibia is similar to that of *manifesta*.

♂ genitalia (Text-fig. 136). Distinguished from *manifesta* by the less deep cleft in the apex of the fulcrum, the depth being equal to one-half of the width of the fulcrum; by the form and size of the shorter digitate projection from the aedeagus, the projection being scobinate and in length equal to one-half of the greatest width of the aedeagus; and by the better developed hook-like projection from the aedeagus.

♀ unknown.

Measurements. Fore wing: ♂ 13–14 mm. Antennal pectinations: ♂ 10 × diameter of shaft.

DISTRIBUTION. Gabon.



Holotype ♂, GABON: Mouila, 3.x.1964 (*P. Darge*) in coll. Herbulot, Paris.

Paratype. GABON: Mouila, 10.ix.1964 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris).

It is with pleasure that I name this species in honour of Monsieur Philippe Darge, the distinguished collector of Cameroun and Gabon Lepidoptera.

### *Zamarada hero* Prout

(Text-figs 137, 138; Pl. 31, figs 573, 574; Pl. 103, fig. 923)

*Zamarada hero* Prout, 1921: 154, pl. 18, fig. 23. Holotype ♂, ZAIRE [examined].

♂♀ (Pl. 103, fig. 923). Hyaline area of wings greyish green (pl. 29, B5), finely edged distally with yellow, then dark brown; penetration of hyaline area into non-hyaline area varies, but usually more extensive than in holotype (Pl. 103, fig. 923); non-hyaline terminal area purplish grey (pl. 14, D2) proximad of broken, dentate, brownish orange subterminal fascia; mainly pale grey to light buff irrorate with purplish grey distad of it; tornus of fore wing and anal angle of hind wing usually clear light buff to white. Underside of non-hyaline terminal area dark brown, apex of fore wing and anal angle of hind wing buff. Anal tuft in male greyish brown.

Male hind femur fringed on inner surface with long, light buff hair-scales; hind tibia dilate with a dense tuft of greyish brown and light buff hair-scales.

♂ genitalia (Text-figs 137, 138). Apex of valve smoothly rounded; dorsal margin narrowly sclerotized; a short, scobinate projection just below level of apex; dorsal process with a short, blunt, setose projection near base; hair-scales of coremata black. Aedeagus finely tapered; a tapered projection at two-thirds, just subequal in length to greatest width of aedeagus; sometimes a minute, sclerotized ridge is present just apicad of tapered projection. Fulcrum simple with rounded apex, similar to that of *excavata*. Vesica with a thorn-like cornutus.

♀ genitalia (Pl. 31, figs 573, 574). Sterigma asymmetrical; posterior margin broadly rounded at left side, bilobate at right side.

Measurements. Fore wing: ♂ 13.0–14.5 mm; ♀ 13 mm. Antennal pectinations: ♂ 8 ×, ♀ 5 × diameter of shaft.

Distinguished externally from *sicula* and *dyscapna* by the deeper green of the hyaline area of the wings and the well contrasted pale areas of the non-hyaline terminal part; further distinguished in the male by the dense greyish brown hair-tuft on the hind tibia and by the greyish brown anal tuft. Distinguished from the closely similar *radula* and *fusticula* by the form of the valve and of the aedeagus in the male genitalia and from *radula* by the form of the asymmetrical sterigma in the female genitalia; the female of *fusticula* is not known.

DISTRIBUTION. Nigeria, Cameroun, Gabon, Zaire, N.W. Angola.

#### MATERIAL EXAMINED.

*Zamarada hero* Prout, holotype ♂, ZAIRE ('Belgian Congo'); Congo River below Lisala, v. 1920 (*T. A. Barns*), Geometridae genitalia slide no. 6405, in BMNH.

NIGERIA: 1 ♂, Ilesha (*Capt. Humfrey*), 1 ♂ (both BMNH). CAMEROUN: Lomie, 4.ix.1962, 1 ♂ (NMR, Bulawayo); Ebolowa, 13.xi.1935, 1 ♂ (CM, Pittsburgh); Route Buea—V.H.F., 900 m, 22.x.1970 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris). GABON: Makokou, 500 m, 5.iii.1962, 1 ♂; ibidem, 10.v.1963, 1 ♂; Belinga, 700 m, 2.iv.1963, 1 ♀; Belinga, 800 m, Piste de Mwadi, 20.iii.1963, 1 ♂; Belinga, 1000 m,

N. Crête Sud, 19.iii.1963, 1 ♂ (all *G. Bernardi*) (all MBG, Paris). ZAIRE ('Belgian Congo'): Matadi, vi. 1931 (*A. Dumez*), 1 ♂ (MNHN, Paris); Embangobango, 17.xi.1949 (*Dr Fontaine*), 1 ♂ (MRAC, Tervuren). ANGOLA: Prov. Nordcuanza, Canzele, 30 km nördl. Quiculungo, 22.ix.1957 (*Gerd Heinrich*), 1 ♂ (ZSBS, Munich); Quirimbo, 75 km E. of P. Amboim, 300 m, 7-12.v.1934 (*Dr K. Jordan*), 3 ♂ (BMNH).

*Zamarada corymbophora* sp. n.

(Text-figs 139, 140; Pl. 30, figs 571, 572; Pl. 103, fig. 926)

♂ ♀ (Pl. 103, fig. 926). Hyaline area of wings greyish yellow (pl. 3, B5, wax-yellow). Non-hyaline terminal area brownish orange (pl. 5, C6); dentate subterminal fascia, a darker shade of brownish orange, direct from costa to vein  $M_3$  on each wing, not incurved. Underside of non-hyaline terminal area dark brown, paler terminad.

Male hind leg: coxa with pocket of deciduous brownish grey scales on dorsal surface; tibia grossly dilate with dense tuft of hair-scales enclosed in longitudinal pocket.

♂ genitalia (Text-figs 139, 140). Valve truncate; apex of dorsal margin produced towards uncus, tip rounded and scobinate; dorsal process dilate and setose near base; hair-scales of coremata light buff. Aedeagus with a short, spatulate projection at two-thirds. Fulcrum weakly sclerotized with rounded apex curved dorsad and with two short, curved projections at two-thirds.

♀ genitalia (Pl. 30, figs 571, 572). Sterigma with broadly rounded, digitate process extending anteriorly. Posterior third of corpus bursae weakly sclerotized.

Measurements. Fore wing: ♂ 13-14 mm; ♀ 13 mm. Antennal pectinations: ♂ 9 ×, ♀ 4 × diameter of shaft.

Distinguished from the closely similar *sicula*, with which it occurs, by the colour and pattern of the wings; by the rather narrower, more brightly coloured non-hyaline terminal area of each wing, by the clearly marked, direct subterminal fascia in the anterior half of each wing and by the absence of light buff from the apex of the non-hyaline terminal area on the underside of the fore wing; distinguished further in the male by the presence of a pocket of specialized scales on the hind coxa and by the grossly dilate hind tibia. In the male genitalia the form of the valve and the ornamentation of the aedeagus and in the female the form of the sterigma are diagnostic.

A male from Lisala [ZAIRE ('Belgian Congo'): Lisala, 5.vi.1912 (*Dr Christy*), in MRAC, Tervuren] agrees in structure with the type-series, but differs in the colour of the darker, greyish brown, non-hyaline terminal area and of the dark brown, dentate subterminal fascia; the hyaline area differs also in extending to the termen between veins  $M_3$  and  $Cu_{1b}$ . The specimen is associated with *corymbophora*, but excluded from the type-series.

DISTRIBUTION. Cameroun, Zaïre.

Holotype ♂, CAMEROUN ('Kamerun'): Lolodorf, 1894-1895 (*L. Conradt*), Geometridae genitalia slide no. 7025, in BMNH.

Paratypes. CAMEROUN: Johann-Albrechts Höhe, 1896 (*L. Conradt*), 1 ♂ (BMNH); Mehandan, 8 km S. of Yaoundé, 17.i.1970 (*P. Darge*), 1 ♀ (coll. Herbulot, Paris); holotype data, 4 ♂; Epulan, 17.iv.1926 (*G. Schwab*), 1 ♂ (all BMNH);

Efulen, 2-18. vi (*H. L. Weber*), 2 ♂, 1 ♀; ibidem, 11-30. x, 3 ♂, 1 ♀ (all CM, Pittsburgh); Ebolowa, Nkoemvom, 19.iv.1970 (*C. Lemaire*), 1 ♂ (coll. Herbulot, Paris).

### *Zamarada aclys* sp. n.

(Text-figs 141, 142; Pl. 104, fig. 935)

♂ (Pl. 104, fig. 935). Hyaline area of wings green, sharply edged distally with dark brown and then more diffusely with glossy grey; costa of fore wing, hind margin of each wing light brown, the former densely irrorate with glossy grey; subcostal vein on hind wing dark grey from base to distal end of cell; discal spots dark grey, minute; excavation of non-hyaline terminal area slender and distinctively shaped, straight-edged posteriorly along vein  $Cu_{1b}$ . Non-hyaline terminal area, extending proximad for one-third of costal margin on fore wing and to one-half of costal margin on hind wing and to one-half of hind margin of each wing, coppery brown (pl. 6, D8) sparsely irrorate with dark brown; dentate subterminal fascia brownish orange (pl. 6, C8) finely edged distally with light buff; cilia chequered buff and grey. Underside of non-hyaline terminal area similar in colour to that of *corymbophora*.

Male hind tibia dilate with tuft of buff hair-scales.

♂ genitalia (Text-figs 141, 142). Distinguished from closely similar *corymbophora* by the more slender apical half of the valve; the apex of the ventral margin is angular, that of the dorsal margin is more slenderly produced and beak-like. Distinguished further by the form of the aedeagus; a tapered, blade-like projection, one-third as long as the aedeagus, arises at one-half and the vesica bears a stout, tapered cornutus.

♀ unknown.

Measurements. Fore wing: ♂ 14-15 mm. Antennal pectinations: ♂ 12 × diameter of shaft.

Distinguished externally from *corymbophora* and from other rather similarly coloured species in the *excavata*-group by the very distinctive shape of the hyaline area of the wings.

DISTRIBUTION. Cameroun, Gabon.

Holotype ♂, CAMEROUN: 8 km N. d'Edea, 30.iii-1.iv.1970 (*C. Herbulot*), in coll. Herbulot, Paris.

Paratype. CAMEROUN: Efulen, 20.iv.1923 (*H. L. Weber*), 1 ♂, in CM, Pittsburgh. GABON: Makokou, Colline Mission biologique, 28.x.1967 (*G. Bernardi*), 1 ♂ (MBG, Paris).

### *Zamarada thalia* Oberthür

(Text-figs 143, 144; Pl. 104, fig. 927)

*Zamarada thalia* Oberthür, 1912: 258, 350, pl. 152, fig. 1459. Holotype ♂, CAMEROUN (BMNH) [examined].

[*Epione transvisaria* Guenée sensu Oberthür, 1912: pl. 152, fig. 1454. Misidentification.]

♂ (Pl. 104, fig. 927). Hyaline area of wings dull yellow to greyish yellow slenderly edged distally with dark brown and silvery grey. Non-hyaline terminal area of wings brown suffused with brownish grey proximally; dentate subterminal fascia dark brown edged distally with silvery grey, direct from costa to vein  $M_3$  on fore wing. Underside of non-hyaline terminal area of wings dark brown.

Male hind leg: coxa with a pocket of deciduous buff scales on dorsal surface; tibia grossly dilate with dense tuft of buff and greyish brown hair-scales in longitudinal pocket.

♂ genitalia (Text-figs 143, 144). Valve truncate; dorsal margin narrowly sclerotized, apical two-fifths produced towards uncus and scobinate along edge; dorsal process slightly dilate and sparsely setose near base; hair-scales of coremata light buff. Aedeagus with a short, thorn-like projection at two-thirds. Fulcrum asymmetrical with a short, digitate projection midway along one side. Vesica with a small, thorn-like cornutus.

♀ unknown.

Measurements. Fore wing: ♂ 17 mm. Antennal pectinations: ♂ 7-8 × diameter of shaft.

Distinguished in the male, together with *laciniata* and *corymbophora*, from other species in the *excavata*-group by the presence of a pocket of deciduous scales on the hind coxa. Very different in colour and wing pattern from *laciniata*; distinguished from *corymbophora* by the dark brown rather than brownish orange, non-hyaline terminal area of the upperside of the wings. In the genitalia the distinctive form of the truncate valve is diagnostic.

DISTRIBUTION. Cameroun, Gabon, Zaire.

#### MATERIAL EXAMINED.

*Zamarada thalia* Oberthür, holotype ♂, CAMEROUN ('Kamerun'): Lolodorf, 1894-1895 (*L. Conradt*), Geometridae genitalia slide no. 6407, in BMNH.

CAMEROUN: holotype data, 3 ♂ (1 ♂ *Zamarada transvisaria* Guenée sensu Oberthür; all BMNH). GABON: Belinga, Piste de Mwadi, 800 m, 20.iii.1963 (*G. Bernardi*), 2 ♂ (MBG, Paris); Mouila, 25.ix-20.x.1964 (*P. Darge*), 5 ♂ (coll. Herbulot, Paris). ZAIRE ('Belgian Congo'): Sankaru, Katako-Kombe, 6.iii.1962, 1 ♂; Lusambo, 8.ix.1950, 1 ♂ (both *Dr Fontaine*, in MRAC, Tervuren).

### *Zamarada astales* sp. n.

(Text-figs 145, 146; Pl. 104, figs 931, 934)

♂ genitalia (Text-figs 145, 146). Valve truncate, apex of ventral margin sclerotized, rounded and thinly ridged, hence apical area of valve scoop-like in form; dorsal margin excavate, apex finely produced and scobinate on ventral surface; dorsal process slightly dilate near base and sparsely setose; hair-scales of coremata light buff. Aedeagus with a small, bicuspid projection at two-thirds. Fulcrum asymmetrical, dilate at one side, rounded at apex. Vesica without cornutus.

♀ unknown.

Measurements. Fore wing: ♂ 15-17 mm. Antennal pectinations: ♂ 9 × diameter of shaft.

Colour and pattern of upper and under surfaces of wings (Pl. 104, fig. 934) closely similar to those of *thalia*. Distinguished by the less smoothly edged excavation of the non-hyaline terminal area of each wing and in the male by the absence of a pocket of specialized scales on the hind coxa; the hind tibia is dilate with a dense tuft of scales enclosed in a longitudinal pocket. In the male genitalia the form of the valve and the aedeagus is diagnostic.

DISTRIBUTION. Cameroun, Uganda.



Holotype ♂, CAMEROUN: 8 km N. d'Edea, 30.iii-I.iv.1970 (*C. Herbulot*), in coll. Herbulot, Paris.

Paratypes. CAMEROUN: 8 km N. d'Edea, 30.iii-9.iv.1970 (*C. Herbulot*), 6 ♂ (coll. Herbulot, Paris).

Two male specimens from W. Uganda (Pl. 104, fig. 931), excluded from the type-series, are identical in structure with the holotype, but differ externally in the slightly greater fore wing length (17 mm : 15 mm) and the differently shaped excavation of the non-hyaline terminal area of the hind wing.

UGANDA: Bwamba, v. 1958 (*R. Carcasson*), 1 ♂ (BMNH), 1 ♂ (NMK, Nairobi).

### *Zamarada penthesis* sp. n.

(Text-figs 147, 148; Pl. 105, fig. 936)

♂ (Pl. 105, fig. 936). Hyaline area of wings yellowish green finely edged distally with dark brown and silvery grey; costa of fore wing buff densely irrorate with grey; costa of hind wing and subcostal vein, from base to angle of cell, light grey; hind margin of each wing grey, the grey on fore wing diffusing anteriorly; discal spots dark grey. Non-hyaline terminal area of a greyish brown (pl. 6, E<sub>4</sub>); dentate subterminal fascia dark brown, finely edged distally with silvery grey. Underside of non-hyaline terminal area greyish brown (pl. 6, E<sub>3</sub>) on fore wing and on hind wing from costa to vein *M*<sub>1</sub>; remainder of terminal area of hind wing densely clothed with specialized scales, brown (pl. 5, E<sub>4</sub>).

Male hind tibia dark grey, grossly dilate and enclosing a dense tuft of light buff hair-scales.

♂ genitalia (Text-figs 147, 148). Apex of dorsal margin of valve produced in beak-like form towards uncus, extension scobinate on basal margin. Projection from two-thirds aedeagus spatulate with rounded apex. Fulcrum tapered and asymmetrical, with triangular projection at two-thirds on left side. Vesica without cornutus.

♀ unknown.

Measurements. Fore wing: ♂ 15.5 mm. Antennal pectinations: ♂ 8 × diameter of shaft.

Readily distinguished by the strikingly distinct pattern of the wings.

DISTRIBUTION. Gabon, Zaire.

Holotype ♂, GABON: Savanes Mwadi, près du Iézé, 1.iv.1963 (*G. Bernardi*), in MBG, Paris.

Paratype. ZAIRE ('Belgian Congo'): Luluabourg, 16.ix.1957 (*C. Seydel*), 1 ♂ (BMNH).

### *Zamarada melpomene* Oberthür

(Text-figs 149, 150; Pl. 31, figs 575, 576; Pl. 104, figs 930, 933)

*Zamarada melpomene* Oberthür, 1912 : 258, 350, pl. 152, fig. 1460. Holotype ♂, CAMEROUN (BMNH) [examined].

*Zamarada melpomene* Oberthür; Gaede, 1915 : 115.

*Zamarada melpomene tragodica* Prout, 1934 : 130. Holotype ♂, TANZANIA (BMNH) [examined]. **Syn. n.**

*Zamarada melpomene* Oberthür; Herbulot, 1954 : 330.

♂ ♀ (Pl. 104, figs 930, 933). Hyaline area of wings greyish yellow, slenderly edged distally with dark brown; posterior margin of hind wing in male densely fringed with grey hair-scales. Non-hyaline terminal area of each wing purplish grey proximad of reddish brown, dentate subterminal fascia, which is slightly bowed proximad on fore wing between costa and vein  $M_3$  and edged conspicuously with white at tornus of fore wing and near anal angle of hind wing; remainder of non-hyaline terminal area putty colour to light grey (Pl. 104, fig. 930). Underside of non-hyaline terminal area of wings dark brown; light buff spots at tornus of fore wing and at anal angle of hind wing.

*Ab. tragodica* Prout (Pl. 104, fig. 933) differs from the typical form in having the non-hyaline terminal area of each wing uniformly dark brown on both upper and under surfaces. Described as a subspecies of *melpomene*, it has subsequently been found occurring with the typical form at Canzele in N. W. Angola, Kampala in Uganda and Kakamega in W. Kenya. Both forms are identical in structure.

In the male the mid and hind femora are fringed with long, buff hair-scales; the hind tibia is dilate and densely tufted with similarly coloured hair-scales.

♂ genitalia (Text-figs 149, 150). Dorsal margin of valve very slenderly sclerotized and scobinate apicad, apex produced slightly and tapered; dorsal process with setose projection near base; hair-scales of coremata light buff. Aedeagus with a rounded apex and a tapered projection at three-fourths. Fulcrum finely tapered at apex, lateral margins smooth. Vesica without cornutus.

♀ genitalia (Pl. 31, figs 575, 576).

Distinguished externally in the male by its large size, by the uniformly light buff fringes and hair-scale tufts on the legs and by the fringe of dark grey hair-scales along the hyaline part of the posterior margin of the hind wing; distinguished in both sexes by the conspicuous pale markings at the tornus of the fore wing and at the anal angle of the hind wing, on both upper and under surfaces. In the male genitalia the form of the valve and in the female the form of the sterigma are diagnostic.

Measurements. Fore wing: ♂ 17–19 mm; ♀ 15–16 mm. Antennal pectinations: ♂ 9 ×, ♀ 3 × diameter of shaft.

DISTRIBUTION. W. Africa, Sierra Leone to Angola, Zaire, Uganda, Ethiopia, W. Kenya, Tanzania, Rhodesia.

#### MATERIAL EXAMINED.

*Zamarada melpomene* Oberthür, holotype ♂, CAMEROUN: Johann-Albrechts Höhe, Station Kamerun, 1898 (*L. Conradt*), Geometridae genitalia slide no. 3323, in BMNH. *Zamarada melpomene tragodica* Prout, holotype ♂, TANZANIA ('Tanganyika T.'): Morogoro, 1931–32 (*J. A. J. Thompson*), Geometridae genitalia slide no. 3325, in BMNH. Type locality originally published as Morogole, in error.

SIERRA LEONE: Njala, xii. 1935 (*E. Hargreaves*), 1 ♂; Bambawo, 13.vi.1969 (*R. Revell*), 2 ♂. GUINEA: Macenta, 2000 ft, 2–21.v.1926 (*C. L. Collenette*), 2 ♂ (all BMNH); Mt Nimba, ix–x. 1951, 6 ♂, 2 ♀ (MNHN, Paris), 2 ♂, 1 ♀ (coll. Herbulot, Paris). IVORY COAST: Bingerville, x–xi (*G. Melou*), 1 ♂, 2 ♀ (BMNH); Gopoupleu, près Danané, 19.i.1959 (*M. Condamin & R. Roy*), 1 ♂ (IFAN, Dakar); Yapou-Sud, 22 km S.S.E. Agboville, 12–18.iv.1969 (*C. Herbulot*), 1 ♂, 1 ♀ (coll. Herbulot, Paris). GHANA: Tarkwa (*A. F. Brazenor*), 1 ♂; Ashanti, Juaso, 2.ix.1937 (*G. S. Cansdale*), 1 ♀; ibidem, 5.xii.1937, 1 ♂. FERNANDO PO (*Rev. W. Cooper*), 1 ♂ (all BMNH). NIGERIA: Mambilla Plateau, Karmantan Forest, 5500 ft, 10.xii.1968 (*H. Roberts*), 2 ♂ (IAR, Zaria); Klimbo, 5500 ft, 22. ix (*G. L. Bates*),

1 ♂; Ilesha (*L. E. H. Humphrey*), 4 ♂; Lagos, vii. 1960 (*J. Boorman*), 1 ♂ (all BMNH). CAMEROON: Johann-Albrechts Höhe, 2.iii.1896 (*L. Conradt*), 1 ♂ (BMNH), 1 ♀ (MNHU, Berlin); N.W. Cameroons, Banjo-Bamenda, 19.xii.1905 (*Dr Guillemain*), 1 ♂; Victoria (*Preuss*), 1 ♂ (both MNHU, Berlin); Bitje, Ja River, 2000 ft, x-xi (*G. L. Bates*), 6 ♂, 1 ♀; ibidem, dry season, 1 ♂ (all BMNH); Efulen, i,v-vi, x-xii (*H. L. Weber*), 16 ♂, 1 ♀ (all CM, Pittsburgh); Nr Banyo, 3000 ft, viii. 1922, 1 ♂ (CM, Pittsburgh); Lomie, 5.ix.1962, 1 ♂ (NMR, Bulawayo). GABON: Crête Sud, 900 m, 19.iii.1963, 2 ♂; ibidem, 29.iii.1963, 1 ♂; Makokou, 500 m, 10.iii.1962, 1 ♂ (all *G. Bernardi*) (all MBG, Paris). ANGOLA: Prov. Nordcuanza, Canzele, 30 km nördl. Quiculungo, 18-22.x.1957 (*Gerd Heinrich*), 10 ♂ (3 typical, 4 ab. *tragodica*, 3 intermediate) (ZSBS, Munich); Quiculungo, 120 km N. of Lucala, 800 m, iv. 1936 (*R. Braun*), 2 ♂; ibidem, v. 1936, 1 ♀; Fazenda Congulu, Amboim district, 700-800 m, 7-16.iv.1934 (*Dr K. Jordan*), 2 ♂, 1 ♀ (all BMNH). ZAIRE ('Belgian Congo'): Matadi (*A. Dumez*) 1 ♂ (MNHN, Paris); Kasai, Lodja, iii. 1959 (*R. Carcasson*), 1 ♂, 1 ♀ (BMNH), 1 ♀ (NMK, Nairobi); Sankaru, Katako-Kombe, iv-vi, xii (*Dr M. Fontaine*), 3 ♂, 1 ♀; Lusambo, vi, vii (*Dr M. Fontaine*), 2 ♂; Uele, Paulis, iii, vi, x (*Dr M. Fontaine*), 3 ♂ (all MRAC, Tervuren); Ituri, Nioka, vii, viii, x (*J. Hecq*), 2 ♂ (MRAC, Tervuren), 1 ♀ (BMNH); Rutshuru, 9.i.1937 (*J. Ghesquière*), 1 ♀; Kivu, Nyamunyunge (Mulungu), 23.iii.1937 (*J. Hecq*), 1 ♂; Kivu, Rwankwi, xii. 1951 (*J. V. Leroy*), 1 ♂ (all MRAC, Tervuren). UGANDA: Kigezi District, Impenetrable Forest, Kanungu, 4500 ft, v. 1952 (*J. A. Burgess*), 1 ♂; Bwamba, v. 1958 (*R. Carcasson*), 1 ♂, 1 ♀ (BMNH), 2 ♂ (NMK, Nairobi); Fort Portal, iii. 1959 (*R. Carcasson*), 1 ♂ (BMNH); Kibale Forest, v. 1966 (*R. Carcasson*), 2 ♂; Budongo, xi. 1964 (*E. S. Brown*), 1 ♂ (all NMK, Nairobi); Kampala, ii, iv (*D. G. Sevastopulo*), 2 ♂; ibidem, xi-xii (*C. M. de Worms*), 1 ♂; Entebbe, iii. 1961 (*N. Mitton*), 1 ♂ (all BMNH); Mabira Forest, Jinja, x. 1962 (*R. Carcasson*), 1 ♂ (NMK, Nairobi), 1 ♀ (BMNH); Kawanda Research Station, i, xi (*D. N. McNutt*), 3 ♂, 1 ♂ (BMNH). ETHIOPIA: Billo (Soddou), 16.i.1925 (*Ungemach*), 1 ♂ (MNHN, Paris). KENYA: Kakamega Forest, 5200 ft, 10-13.vii.1960 (*A. C. Twomey*), 3 ♂, 1 ♀ (CM, Pittsburgh); Kakamega, iii. 1966 (*R. Carcasson*), 2 ♂; ibidem, v. 1967, 1 ♂ (all NMK, Nairobi) (2 ♂, 1 ♀ are typical *melpomeme*, 4 ♂ are ab. *tragodica*); Kaptagat, 5.ii.1949 (*Walter*), 1 ♂ (NMK, Nairobi); Mt. Kenya, viii-x. 1927 (*A. Insoll*), 1 ♂ (BMNH). RHODESIA: Vumba Mts., i. 1958, 1 ♂ (NMR, Bulawayo).

### *Zamarada incompta* sp. n.

(Text-figs 151, 152)

♂. Hind tibia simple.

♂ genitalia (Text-figs 151, 152). Valve simple, dorsal margin setose in apical half, sclerotized and minutely scobinate at base; dorsal process with short, blunt, setose projection at one-fourth. Aedeagus blade-like apicad; two small, tooth-like projections at two-thirds. Fulcrum simple and weakly sclerotized, not extending to tip of aedeagus. Vesica without cornutus.

♀ Unknown.

Measurements. Fore wing: ♂ 12-13 mm. Antennal pectinations: ♂ 15 × diameter of shaft.



Distinguished externally from *sicula* (Pl. 103, fig. 920), with which it is almost identical in colour and pattern, by the uniformly dark brown underside of the non-hyaline terminal area of each wing and in the male by the simple hind tibia. In the genitalia the form of the valve and aedeagus is diagnostic.

DISTRIBUTION. Cameroun, Zaire.

Holotype ♂, CAMEROUN ('Kamerun'): Efulen, 17.iv.1923 (*H. L. Weber*), in CM, Pittsburgh.

In two male specimens from Zaire the projections from the aedeagus are better developed. The specimens are associated with *incompta*, but are excluded from the type series.

ZAIRE ('Belgian Congo'): Congo Forest, 6.iii.1907 (*A. F. R. Wollaston*), 1 ♂ (BMNH); Prov. Orientale, Lomami River, Opala, iii. 1959 (*R. H. Carcasson*), 1 ♂ (BMNH).

### *Zamarada setosa* sp. n.

(Text-figs 153, 154; Pl. 32, figs 577, 578; Pl. 104, fig. 929)

♂ ♀ (Pl. 104, fig. 929). Hyaline area of wings greyish yellow (pl. 3, B4, straw yellow) finely edged distally with dark brown; posterior margin of hind wing densely fringed with grey hair-scales on underside in male. Non-hyaline terminal area of wings brownish orange (pl. 6, C5, Sahara); subterminal fascia brownish orange, dentate and broken. Underside of non-hyaline terminal area of wings dark brown, paler terminad.

Male hind leg: femur fringed with long, buff hair-scales; tibia dilate and densely tufted with similarly coloured hair-scales.

♂ genitalia (Text-figs 153, 154). Uncus slenderly produced and tapered, the tip hook-like and curved ventrad. Valve rounded at apex, apical half setose along margins; dorsal process with a large, triangular, setose projection near base; hair-scales of coremata greyish yellow. Aedeagus with a short, truncate projection arising at two-thirds. Fulcrum with a pair of angular projections at one-half. Vesica with a thorn-like cornutus.

♀ genitalia (Pl. 32, figs 577, 578). Sterigma with a slight, anteriorly inclined dilation at right side.

Measurements. Fore wing: ♂ 14–18 mm; ♀ 14 mm. Antennal pectinations: ♂ 8 ×, ♀ 3 × diameter of shaft.

Distinguished externally from similarly coloured *corymbophora*, *thalia* and *sicula* by the less deep penetration of hyaline into the non-hyaline terminal area and in the male by the densely fringed posterior margin of the hyaline area on the underside of the hind wing. In the genitalia the form of the uncus, valve and aedeagus and in the female the form of the sterigma are diagnostic.

DISTRIBUTION. W. Uganda; Zaire.

Holotype ♂, UGANDA: Bwamba, v. 1958 (*R. Carcasson*), Geometridae genitalia slide no. 7163, in BMNH.

Paratypes. UGANDA: holotype data, 3 ♂, 2 ♀; ibidem, vi. 1956, 1 ♂, 1 ♀; Toro, Bwamba, ix. 1961 (*N. Mitton*), 1 ♂, 1 ♀; Fort Portal, v. 1958 (*R. Carcasson*), 1 ♂; Toro, Kibale Forest, v. 1966 (*R. H. Carcasson*), 1 ♂; Queen Elisabeth National Park, Mweya, vii. 1964, 1 ♀ (all NMK, Nairobi); Albert Nyanza, Butiabo, 2028 ft,



4.ix.1928, 1 ♀ (BMNH). ZAIRE ('Belgian Congo'): Kilomines, 1939 (*Lepersonne*), 2 ♂ (MRAC, Tervuren); Eastern Upper Ituri Valley, 30 miles S. of Irumu, 3000 ft, vii. 1924, tropical forest (*T. A. Barns*), 1 ♂ (BMNH); Uele, Paulis, 9.iv.1956 (*Dr M. Fontaine*), 1 ♂; *ibidem*, 5.viii.1957, 1 ♂ (all MRAC, Tervuren).

### *Zamarada oxybeles* sp. n.

(Text-figs 155, 156; Pl. 32, figs 579, 580; Pl. 105, fig. 937)

♂ ♀ (Pl. 105, fig. 937). Hyaline area of wings greyish yellow (pl. 3, B<sub>4</sub>, straw-yellow). Non-hyaline terminal area of wings brownish orange (pl. 6, C<sub>5</sub>, Sahara) to greyish brown (pl. 5, E<sub>3</sub>, mouse-grey); subterminal fascia brownish orange, dentate and curved proximad between costa and vein *M*<sub>3</sub> on fore wing. Underside of non-hyaline terminal area uniformly dark brown.

Hind tibia in male simple.

♂ genitalia (Text-figs 155, 156). Apical half of uncus of even width to rounded tip. Valve finely tapered, tip acicular; dorsal margin sclerotized; dorsal process dilate and setose at one-fourth; hair-scales of coremata light buff. Aedeagus with rounded apex; a blunt, spatulate projection, smooth-edged or shortly spined at one side, is situate at two-thirds. Fulcrum tapered to acicular tip, without lateral projections. Vesica with a stout, tapered cornutus.

♀ genitalia (Pl. 32, figs 579, 580).

Measurements. Fore wing: ♂ ♀ 13-14 mm. Antennal pectinations: ♂ 11 ×, ♀ 5 × diameter of shaft.

Distinguished from the externally similar *calypso* Prout and *viettei* sp. n. by the distinct proximad curve of the subterminal fascia between the costa and vein *M*<sub>3</sub> on the fore wing; in the other two species the subterminal fascia is straight on the anterior half of the fore wing; distinguished further by the rather deeper and smoother-margined intrusion of the hyaline area into the patterned terminal area of each wing and from *viettei* by the uniformly greyish brown colour of the underside of the non-hyaline terminal area of the wings. In the male genitalia the finely tapered valve with its straight, acicular tip and in the female genitalia the form of the sterigma are diagnostic.

DISTRIBUTION. Central and eastern Madagascar.

Holotype ♂, MADAGASCAR: Station Perinet, 149 km east of Tananarivo, i. 1933 (*Mme N. d'Olsoufieff*), Geometridae genitalia slide no. 7058, in BMNH.

Paratypes. MADAGASCAR: holotype data, 5 ♂; *ibidem*, ii. 1935, 1 ♂, 1 ♀; iii. 1935, 3 ♂; 20.x.-19.xi.1930, 1 ♂; xii. 1932, 1 ♂, 4 ♀; Tananarive, 1 ♀; Tananarive (*Stichel*), 1 ♀; Ambinanindrano, W. of Mahonoro, 10.vi (*G. K. Kestell-Cornish*), 1 ♀; Ankarampotsy, near Fianarantsoa, col de Tantamaly, xii. 1933 (*R. Catala*), 4 ♂, 8 ♀ (all BMNH); Madagascar Centre, route d'Ambositra à Ambohimanga du Sud, km 39, 1350 m, 6-11.xi.1963 (*P. Viette*), 1 ♂; La Mandraka, 1200 m, 10-13.iii.1964 (*P. Viette*), 1 ♀; Madagascar Est, Fort Dauphin, Forêt d'Isaka, 1 ♂; route d'Anosibe, km 52, 1.i.1957 (*P. Griveaud et R. Vieu*), 1 ♂; *ibidem*, 15.x.1955, 1 ♀; env. de Perinet, Concess. R. Izouard, 1025 m, 7-10.xi.1967 (*P. Viette et P. Griveaud*), 1 ♂; env. de Perinet, forêt d'Analamazoatra, 14.i.1955

(*P. Viette*), 1 ♂; ibidem, 25-27.xi.1954, 3 ♂, 1 ♀; 24.xii.1954, 1 ♂, 1 ♀; ibidem, x. 1955 (*R. Vieu*), 1 ♂ (all MNHN, Paris); Perinet, Analamazoatra, 11-19.iii.1955 (*C. Herbulot*), 3 ♂ (coll. Herbulot, Paris); Ranomafana, R.I.G.8 au km 401, 26-30.iii.1955 (*C. Herbulot*), 2 ♂, 1 ♀ (coll. Herbulot, Paris); Marojejy, rés. nat. int. XII, Ambatosoratra, 1000 m, viii. 1960 (*P. Soga*), 2 ♂; Marojejy, res. nat. int. XII, Beondroka, 1200 m, xii. 1960 (*P. Soga*), 1 ♂; district de Maroantsetra, station forestière de Farankaraina, route de Navarna, km 16, 5, vallée d'Antoroka, 8-18.i.1964 (*P. Viette*), 1 ♂, 1 ♀; Baie d'Antongil, Nosy Mangabe, 200 m, 19-21.i.1968 (*P. Griveaud et A. Peyrieras*), 3 ♂; Madagascar Nord, route du Haut Sambirana, 10 km d'Ambanja, col du Bekaka, 140 m, 16-17.xii.1963 (*P. Viette et P. Soga*), 2 ♀; Nossi-Bé, 150 m, Forêt de Lokobe, 3-9.xi.1958 (*P. Viette*), 3 ♀; Madagascar Ouest, Andobo, Forêt de l'Antsingy, dist. d'Antsalova, xi. 1957 (*P. Griveaud*), 1 ♂ (all MNHN, Paris).

### *Zamarada subinterrupta* Gaede

(Text-figs 157, 158; Pl. 33, figs 581, 582; Pl. 104, fig. 928)

*Zamarada subinterrupta* Gaede, 1915 : 121, pl. 2, fig. 17. Holotype ♂, NIGERIA (MHNU, Berlin) [examined].

♂ ♀ (Pl. 104, fig. 928). Hyaline area of wings greyish yellow. Non-hyaline terminal third of each wing in male brown; dentate subterminal fascia dark brown edged distally with white, sharply marked. Non-hyaline terminal third of each wing in female brownish grey; dentate subterminal fascia raw sienna. Underside of non-hyaline terminal area of each wing brown in both sexes, apex of fore wing putty colour.

In the male the hind tibia is dilate with a pencil of long hair-scales.

♂ genitalia (Text-figs 157, 158). Apical three-fourths of dorsal margin of valve weakly but densely scobinate; dorsal process dilate and setose at one-third; hair-scales of coremata black. Aedeagus with a small, thorn-like projection at two-thirds. Fulcrum longer than aedeagus with two asymmetrical, tapered projections at one-half; apical half spatulate with rounded apex. Vesica without cornutus.

♀ genitalia (Pl. 33, figs 581, 582). Slender, arcuate band of sterigma minutely serrate-edged posteriorly in example illustrated; the margin is smooth-edged in some examples.

Measurements. Fore wing: ♂ 14 mm; ♀ 13-14 mm. Antennal pectinations: ♂ 10 ×, ♀ 4 × diameter of shaft.

Closely similar externally to *protrusa* Warren; distinguished by the less regular outline of the hyaline intrusions into the patterned terminal area and in the male by the presence of a dilate hind tibia with a pencil of long hair-scales. In the male genitalia the scobinate dorsal margin of the valve and the form of the fulcrum and in the female the arcuate sterigma are diagnostic.

DISTRIBUTION. Sierra Leone, Liberia, Ivory Coast, Nigeria, Zaire.

#### MATERIAL EXAMINED.

*Zamarada subinterrupta* Gaede, holotype ♂, NIGERIA: south, Opobo (*G. Schütze*), in MNHU, Berlin.

SIERRA LEONE: Njala, 21.v.1926 (*E. Hargreaves*), 1 ♀. LIBERIA: 12 miles E of Monrovia, below 100 ft, rainy season, vi. 1926 (*M. Portal Hyatt*), 1 ♀; ibidem, vii. 1926, 1 ♀. IVORY COAST: Bingerville, 11-14.viii.1915 (*G. Melou*), 1 ♀; ibidem, xi. 1913, 1 ♀ (all BMNH); Gopoupleu près Danané, i. 1959 (*M. Condamin & R. Roy*), 1 ♂ (IFAN, Dakar); Lamto, 36 km N.N.W. de Tiassalé, 20-23.iv.1969 (*C. Herbulot*), 1 ♂ (coll. Herbulot). NIGERIA: Degama (*Dr Ansorge*), 2 ♂; Agberi, Niger, 20.vi.1901 (*Ansorge*), 1 ♂; Warri, 26.iv.1897 (*Dr Roth*), 1 ♂ (all BMNH). ZAIRE ('Belgian Congo'): Bamanian (près Coquilhatville) (*R. P. Hulstaert*), 1 ♂; Lusambo, 21.vi.1949 (*Dr M. Fontaine*), 1 ♂ (both MRAC, Tervuren).

### *Zamarada lophobela* sp. n.

(Text-figs 159, 160; Pl. 33, figs 583, 584; Pl. 104, fig. 932)

♂ (Pl. 104, fig. 932). Hind tibia dilate with pencil of light buff hair-scales.

♂ genitalia (Text-figs 159, 160). Apical three-fifths of dorsal margin of valve coarsely scobinate, tip folded dorsad, curved towards uncus and tapered. Aedeagus with digitate projection at three-fourths. Fulcrum short, not extending to tip of aedeagus; broad, lateral margins irregularly crenulate. Vesica with a short, hook-like cornutus and a scobinate band one-half as long as aedeagus.

♀ genitalia (Pl. 33, figs 583, 584). Lamella antevaginalis asymmetrical with posteriorly inclined, tapered projection at right side. Lamella postvaginalis with a pair of finely tapered, posteriorly inclined projections, one at each side. Posterior half of corpus bursae ribbed and sclerotized.

Measurements. Fore wing: ♂ 12-14 mm; ♀ 12-13 mm. Antennal pectinations: ♂ 9 ×, ♀ 3 × diameter of shaft.

Externally closely similar to *melanopyga* Herbulot and *cantela* sp. n. in the *protrusa*-group, differing from them in the presence of a dilate hind tibia in the male and from *melanopyga* in the uniformly greyish brown abdomen, lacking the conspicuous dark grey terminal segment of that species. Differs structurally from both these and other species in the *excavata*- and *protrusa*-groups in the form of the valve and the ornamentation of the vesica in the male genitalia and in the form of the sterigma and the extent of the sclerotization of the corpus bursae in the female genitalia.

DISTRIBUTION. Gabon.

Holotype ♂, GABON: Mouila, 20.x.1964 (*P. Darge*), in coll. Herbulot, Paris.

Paratypes. GABON: Mouila, 25.ix.-1.xi.1964 (*P. Darge*), 9 ♂, 8 ♀ (coll. Herbulot, Paris).

### THE *PROTRUSA*-GROUP

A group closely similar in habitus to many species in the *excavata*-group and closely similar in structure, in the form of the uncus and in the absence of a ventral plate on the gnathus in the male genitalia.

Characterized in the male genitalia by the dense covering of short hair-scales on the dorsal surface of the valves (Pl. 94, fig. 835), which are weakly sclerotized,

simple and boldly rounded apicad in *protrusa*, *sinecalcarata*, *disparata*, *antimima*, *bernardii* and *carcassoni*; in other species the apices are tapered; only in *strigilecula* is the valve ornamented, the dorsal margin being coarsely scobinate.

In the male the hind tibia is simple in all species except *urania*, in which there is a very short tuft of specialized scales; these are more readily discernible in slide-mounted specimens.

KEY TO SPECIES AND SUBSPECIES

- 1 Projection from three-fourths aedeagus acicular, its ventral surface, next aedeagus, scobinate . . . . . 2
- Aedeagus with or without projection; if present, projection never scobinate. . . . . 3
- 2 (1) Apex of dorsal margin and apical margin of valve angled at 90 degrees and smooth-edged. Lateral margins of fulcrum crenulate at two-thirds.  
*bernardii* (p. 111)
- Apex of dorsal margin of valve produced and serrate-edged. Fulcrum with a pair of angular projections at two-thirds . . . . . *carcassoni* (p. 110)
- 3 (1) Apex of valve truncate or broadly rounded, all margins smooth, broad apical margin not less than one-half of the greatest width of the valve. Cornutus straight and acicular . . . . . 4
- Apex of valve tapered or apex of dorsal margin produced and tapered; or apex narrowly rounded with dorsal margin weakly serrate apicad and vesica with a hook-like cornutus curved through 90 degrees . . . . . 9
- 4 (3) Aedeagus with acicular projection at three-fourths . . . . . 5
- Aedeagus without projection . . . . . 7
- 5 (4) Valve truncate; apex of ventral margin abruptly curved, that of dorsal margin angled through 90 degrees (Text-fig. 173). Apical sixth of aedeagus with conspicuous, sclerotized longitudinal ridge. Non-hyaline terminal area of wings predominantly orange-grey . . . . . *antimima* (p. 111)
- Apex of valve rounded, ventral margin gently and gradually curved (Text-fig. 161). Apical sixth of aedeagus without longitudinal ridge . . . . . 6
- 6 (5) Fulcrum with a pair of angular projections at two-thirds. Distribution: Guinea to Nigeria . . . . . *protrusa protrusa* (p. 107)
- Fulcrum without a pair of angular projections; apical third smooth or serrate  
*protrusa serrula* (p. 108)
- 7 (4) Greatest width of valve equal to two-thirds of length of its dorsal margin, from apex to base of dorsal process. Apical third of fulcrum serrate-edged or bearing a pair of angular projections at three-fourths. Hyaline area extending distad between veins  $M_3$  and  $Cu_{1b}$  similarly on fore and hind wings . . . . . 8
- Greatest width of valve equal to length of its dorsal margin, from apex to base of dorsal process. Apical eighth of fulcrum serrate-edged. Hyaline area between veins  $M_3$  and  $Cu_{1b}$  extending to one-half non-hyaline terminal area of fore wing, but to termen on hind wing . . . . . *disparata* (p. 109)
- 8 (7) Fulcrum serrate-edged in apical third. Acicular cornutus one-half as long as greatest width of aedeagus. Hyaline area extending to termen between veins  $M_3$  and  $Cu_{1b}$  on each wing . . . . . *sinecalcarata* (p. 108)
- Fulcrum with a pair of angular projections at three-fourths. Acicular cornutus equal in length to greatest width of aedeagus. Hyaline area extending to one-half non-hyaline terminal area between veins  $M_3$  and  $Cu_{1b}$  on each wing . . . . . *lanceolata* (p. 109)



|    |      |                                                                                                                                                                                                                                        |                                     |    |
|----|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|----|
| 9  | (3)  | Dorsal third of valve strongly sclerotized; apical half of sclerotized area coarsely scobinate . . . . .                                                                                                                               | <i>strigilecula</i> (p. 112)        | 10 |
| -  |      | Valve not so formed . . . . .                                                                                                                                                                                                          |                                     | 11 |
| 10 | (9)  | Aedeagus with projection from between two-thirds to three-fourths . . . . .                                                                                                                                                            |                                     | 17 |
| -  |      | Aedeagus without projection . . . . .                                                                                                                                                                                                  |                                     | 12 |
| 11 | (10) | Vesica with cornutus . . . . .                                                                                                                                                                                                         |                                     | 14 |
| -  |      | Vesica without cornutus . . . . .                                                                                                                                                                                                      |                                     |    |
| 12 | (11) | Apex of valve tapered and inclined towards uncus, apical area triangular in shape (Text-fig. 191). Cornutus scobinate. Non-hyaline terminal area of wings predominantly purplish grey . . . . .                                        | <i>uranía</i> (p. 118)              | 13 |
| -  |      | Valve of even width to broadly rounded apical margin; apex of dorsal margin finely produced and inclined towards uncus (Text-figs 177, 179). Cornutus smooth. Non-hyaline terminal area of wings predominantly reddish brown . . . . . |                                     |    |
| 13 | (12) | Finely produced apex of dorsal margin of valve acicular in form and minutely scobinate. Projection from two-thirds aedeagus straight and acicular, basal two-thirds of even width . . . . .                                            | <i>ferruginata</i> (p. 113)         |    |
| -  |      | Finely produced apex of dorsal margin bifurcate at tip. Projection from three-fourths aedeagus broad-based and thorn-like . . . . .                                                                                                    | <i>arguta</i> (p. 113)              |    |
| 14 | (11) | Fulcrum broadened asymmetrically at apex, extending beyond and enfolding apex of aedeagus; apex with two unequal projections, each with a short, thorn-like tip. Non-hyaline terminal area of wing predominantly dark brown . . . . .  | <i>fibulata</i> (p. 117)            |    |
| -  |      | Fulcrum not so formed. Non-hyaline terminal area of wings predominantly reddish brown . . . . .                                                                                                                                        |                                     | 15 |
| 15 | (14) | Dorsal margin of valve with serrate ridge in apical fourth. Projection from aedeagus arising at two-thirds . . . . .                                                                                                                   | <i>chrysopa</i> (p. 116)            |    |
| -  |      | Dorsal margin of valve smooth. Projection from aedeagus arising at three-fourths . . . . .                                                                                                                                             |                                     | 16 |
| 16 | (15) | Ground colour of non-hyaline terminal area yellowish brown; proportion of non-hyaline to hyaline area at costa of fore wing 5 : 11 to 5 : 13 . . . . .                                                                                 | <i>dentigera dentigera</i> (p. 115) |    |
| -  |      | Ground colour of non-hyaline terminal area straw yellow; proportion of non-hyaline to hyaline areas at costa of fore wing 4 : 14 to 4 : 15 . . . . .                                                                                   | <i>dentigera stenotes</i> (p. 116)  |    |
| 17 | (10) | Vesica with two cornuti, one tapered and hook-like, one scobinate . . . . .                                                                                                                                                            |                                     | 18 |
| -  |      | Vesica with one cornutus . . . . .                                                                                                                                                                                                     |                                     | 19 |
| 18 | (17) | Valve tapered to narrowly rounded apex; hair-scales of coremata greyish buff. Fulcrum smooth-edged . . . . .                                                                                                                           | <i>aglae</i> (p. 120)               |    |
| -  |      | Apex of valve produced in digitate form, extension two-thirds as long as uncus; hair-scales of coremata black. Fulcrum with a pair of angular projections at three-fourths . . . . .                                                   | <i>melanopyga</i> (p. 119)          |    |
| 19 | (17) | Valve with a tapered, digitate projection two-thirds as long as uncus, extending posteriorly from mid-apical margin. Apex of fulcrum dilate, margins asymmetrically serrate . . . . .                                                  | <i>ariste</i> (p. 121)              |    |
| -  |      | Valves and fulcrum not so formed . . . . .                                                                                                                                                                                             |                                     | 20 |
| 20 | (19) | Cornutus curved abruptly through 90 degrees at mid-length. Fulcrum sinuous in apical half, margin dilate at three-fourths . . . . .                                                                                                    |                                     | 21 |
| -  |      | Cornutus not curved abruptly. Fulcrum slender and smooth, rod-like in apical half . . . . .                                                                                                                                            |                                     | 22 |
| 21 | (20) | Apex of valve rounded, apical fourth of dorsal margin very weakly sclerotized, the margin weakly serrate (Text-fig. 201) . . . . .                                                                                                     | <i>phoenopasta</i> (p. 122)         |    |
| -  |      | Apex of valve curved, apex of dorsal margin produced in digitate form towards uncus (Text-fig. 195) . . . . .                                                                                                                          | <i>ostracodes</i> (p. 120)          |    |

- 22 (20) Finely tapered apex of valve curved through 90 degrees towards uncus. Short cornutus spatulate and diagonally truncate. Distal margin of hyaline area on fore wing straight from costa to posterior margin, that on hind wing acutely angled terminad between vein  $M_3$  and anal margin *miranda* (p. 123)
- Finely tapered apex of valve inclined towards uncus. Short cornutus thorn-like, base scobinate at one side. Distal margin of hyaline area of each wing roundly bowed terminad between veins  $M_3$  and  $Cu_{1b}$  . . . *cautela* (p. 123)

### *Zamarada protrusa* Warren

(Text-figs 161-163; Pl. 34, figs 585, 586; Pl. 105, fig. 938)

*Zamarada protrusa* Warren, 1897 : 123.

♂ ♀ (Pl. 105, fig. 938). Hyaline area of wings greyish yellow (pl. 3, B5, wax-yellow) edged finely with dark grey and silvery grey along distal margin. Non-hyaline terminal area of each wing greyish orange (pl. 6, B4-5) more or less irrorate with grey. Underside of non-hyaline terminal area of wings dark brown, paler terminad and at apex of fore wing.

♂ genitalia (Text-figs 161-163). Valve simple, weakly sclerotized, ventral margin evenly curved to rounded apex; dorsal process dilate and setose or with a short, setose projection near base; hair-scales of coremata light buff. Aedeagus tapered apicad with an acicular projection at two-thirds. Fulcrum with a pair of angular projections at two-thirds or smooth or serrate in apical third. Vesica with a cornutus similar in size and shape to the projection from the aedeagus.

♀ genitalia (Pl. 34, figs 585, 586). Sterigma with a tapered, digitate process extending anteriorly at left side; posterior margin of lamella postvaginalis symmetrical. Posterior half of corpus bursae sclerotized and weakly ribbed.

Measurements. Fore wing: ♂ 13-17 mm; ♀ 14-16 mm. Antennal pectinations: ♂ 8 ×, ♀ 4 × diameter of shaft.

DISTRIBUTION. West Africa, Guinea to Gabon.

Two subspecies are recognized, distinguished by the colour of the non-hyaline terminal area of the wings and by the structure of the fulcrum.

### *Zamarada protrusa protrusa* Warren

(Text-figs 161, 162; Pl. 105, fig. 938)

*Zamarada protrusa* Warren, 1897 : 123. Holotype ♀, NIGERIA (BMNH) [examined].

*Zamarada protrusa* Warren; Swinhoe, 1904 : 515.

Non-hyaline terminal area of wings greyish orange (pl. 6, B4) irrorate with grey. In the male genitalia the fulcrum has a pair of angular projections at two-thirds.

DISTRIBUTION. Guinea, Sierra Leone, Ivory Coast, Ghana, Nigeria, Central African Republic.

MATERIAL EXAMINED.

*Zamarada protrusa* Warren, holotype ♀, NIGERIA: Akassa, Rio Niger, Geometridae genitalia slide no. 5999, in BMNH.

GUINEA: Macenta, 2000 ft, 2-21.v.1926 (C. L. Collette), 1 ♂ (BMNH); Ghéckédou

(*Korecká*), 1 ♂ (MM, Brno). SIERRA LEONE: Moyamba, v. 1903 (*D. Cator*), 1 ♀; Freetown, Mt. Aureol, ii. 1956 (*J. Phipps*), 1 ♂. IVORY COAST: Bingerville, viii-xi (*G. Melou*), 1 ♂, 2 ♀ (all BMNH); Yapo-Sud, 22 km S.S.E. of Agboville, 12-18.iv.1969 (*C. Herbulot*), 1 ♂; Lamto, 36 km N.N.W. of Tiassalé, 20-23.iv.1969 (*C. Herbulot*), 1 ♂ (both coll. Herbulot, Paris). GHANA: Aburi, 1 ♂; Bibiani (Bibianaha), 70 miles N.W. of Dunkwa (Dimkwa), 700 ft (*H. G. F. Spurrell*), 1 ♀. NIGERIA: Lagos, 1 ♂; ibidem (*H. Strachan*), 1 ♀; ibidem, 17.vii.1906 (*G. L. Boag*), 1 ♂; Warri, ii, iv (*Dr Roth*), 2 ♂, 1 ♀. CENTRAL AFRICAN REPUBLIC: Bangui, 1 ♀ (all BMNH); Bimbo, 24.iv.1970 (*C. Lemaire*), 1 ♂ (coll. Herbulot, Paris).

### *Zamarada protrusa serrula* subsp. n.

(Text-fig. 163)

[*Epione transvisaria* Guenée sensu Oberthür, 1912: pl. 152, fig. 1455. Misidentification.]

Distinguished from the nominate subspecies by the brighter greyish orange non-hyaline terminal area of the wings, which is markedly less irrorate with grey. In the male genitalia the fulcrum lacks the angular projections and is either smooth or serrate-edged in its apical third.

DISTRIBUTION. Cameroun, Gabon, Zaire.

Holotype ♂, CAMEROUN ('Kamerun'): Lolodorf, 1894-1895 (*L. Conradt*), Geometridae genitalia slide no. 7061, in BMNH.

Paratypes. CAMEROUN: Efulen, 10.iii.1923 (*H. L. Weber*), 1 ♂; ibidem, 19.iv.1923, 1 ♂; 3.v.1913, 1 ♂; 18.v.1922, 1 ♂; 2.viii.1918, 1 ♂; 13.xii.1924, 1 ♂ (all CM, Pittsburgh). GABON: Belinga, Camp Central, 500 m, 25.iii.1963, 2 ♂; Belinga, 700 m, 2.iv.1963, 1 ♂; Belinga, 700 m, 14.v.1963, 1 ♂; Belinga, Piste de Mwadi, 800 m, 20.iii.1963, 2 ♂; Savanes de Mwadi, près du Iézé, 20.v.1963, 1 ♂; Belinga, 900 m, N. Crête Sud, 29.iii.1963, 1 ♂; Makokou, 500 m, iv. 1963, 1 ♂ (all *G. Bernardi*, MBG, Paris); Mouila, 1-3.x.1964 (*P. Darge*), 2 ♂ (coll. Herbulot, Paris).

Associated with subsp. *serrula*, but excluded from the type-series: ZAIRE ('Belgian Congo'): Prov. Orientale, Opala, iii. 1959 (*R. H. Carcasson*), 1 ♂ (NMK, Nairobi); Sankaru, Katoko-Kombe, 11.iii.1952 (*Dr M. Fontaine*), 1 ♂ (MRAC, Tervuren).

### *Zamarada sinecalcarata* sp. n.

(Text-figs 164, 165; Pl. 34, figs 587, 588; Pl. 105, fig. 939)

♂ ♀ (Pl. 105, fig. 939). Wings similar in colour to those of the nominate subspecies of *protrusa*, but differing in the extension of the hyaline area to the termen between veins  $M_3$  and  $Cu_{1b}$ .

♂ genitalia (Text-figs 164, 165). Closely similar to those of *protrusa serrula*, differing in the form of the aedeagus with its more slender apex and in the absence of an acicular projection at two-thirds. Acicular cornutus, similar to that of *protrusa*, one-half as long as the greatest width of the aedeagus.

♀ genitalia (Pl. 34, figs 587, 588). Anterior margin of sterigma narrowly arcuate. Posterior margin of lamella postvaginalis asymmetrical.

Measurements. Fore wing: ♂ 15 mm; ♀ 14 mm. Antennal pectinations: ♂ 10 ×, ♀ 3 × diameter of shaft.

DISTRIBUTION. Nigeria.

Holotype ♂, NIGERIA: south, Ilesha (*L. E. H. Humfrey*), Geometridae genitalia slide no. 1682, in BMNH.

Paratypes. NIGERIA: holotype data, 2 ♀; Lagos, 1 ♂; Ibadan, Jericho, 3.x.1959 (*J. Riley*), 1 ♂ (all BMNH).

### *Zamarada lanceolata* sp. n.

(Text-fig. 166; Pl. 35, figs 589, 590; Pl. 105, fig. 941)

♂ ♀ (Pl. 105, fig. 941). Hyaline area of wings tinged with greyish yellow (pl. 3, B5, wax-yellow), as in *protrusa protrusa*, sparsely striate with brown posterior of discal area and finely edged distally with black; costa of fore wing brown irrorate with silvery grey; costa of hind wing and anterior half of subcostal vein grey; posterior margin of each wing brown; discal spots minute, black. Non-hyaline terminal area brownish orange (pl. 6, C6, cinnamon); dentate subterminal fascia brown (pl. 6, D8, light brown) finely edged distally with light buff and weakly suffused proximally with reddish grey; cilia chequered buff and grey. Underside of non-hyaline terminal area light brown (pl. 6, D4) in apical area of fore wing and terminad on each wing, suffused with brownish grey (pl. 6, E2), densely proximad. Tip of abdomen in male suffused with grey.

♂ genitalia (Text-fig. 166). Distinguished from closely similar *sinecalcarata* by the longer acicular cornutus, which is equal in length to the greatest width of the aedeagus and by the presence on the fulcrum of a pair of angular projections at three-fourths.

♀ genitalia (Pl. 35, figs 589, 590). Distinguished from those of the closely similar *sinecalcarata* by the smaller, less developed sterigma.

Measurements. Fore wing: ♂ 14–15 mm; ♀ 15 mm. Antennal pectinations: ♂ 10 ×, ♀ 4 × diameter of shaft.

Closely similar in colour and pattern to *protrusa serrula*, from which males may be distinguished by the grey-tipped abdomen; in *protrusa serrula* the tip of the abdomen is brown. Distinguished structurally in the genitalia of both sexes as indicated above.

DISTRIBUTION. Gabon.

Holotype ♂, GABON: Mouila, 25.ix.1964 (*P. Darge*), in coll. Herbulot, Paris.

Paratypes. GABON: Mouila, 30.ix.1964 (*P. Darge*), 1 ♀; ibidem, 3.x.1964, 2 ♂; Abanga, 24.xi.1968 (*P. Darge*), 1 ♂ (all coll. Herbulot, Paris).

A male without data, labelled 'Holland Collection' is in CM, Pittsburgh.

### *Zamarada disparata* sp. n.

(Text-figs 167, 168; Pl. 105, figs 943)

♂ (Pl. 105, fig. 943). Hyaline area similar to that of *protrusa*, extending almost to termen on hind wing between veins  $M_3$  and  $Cu_{1b}$ , but only to one-half of the width of the patterned



terminal area on the fore wing. Upperside of vestiture and non-hyaline terminal area of wings brownish orange to light brown (pl. 6, C-D6); dentate subterminal fascia weakly marked in a darker shade. Underside: vestiture light buff, tip of abdomen dark brown; non-hyaline terminal area of wings dark brown.

♂ genitalia (Text-figs 167, 168). Closely similar to those of *sinecalcarata*, differing in the appreciably broader valve, the greatest width being equal to the length of the dorsal margin from its apex to the base of the dorsal process, and in the form of the fulcrum, which is serrate-edged in its apical eighth.

♀ unknown.

Measurements. Fore wing: ♂ 17 mm. Antennal pectinations: ♂  $8 \times$  diameter of shaft.

Externally distinct in the *protrusa*-group in the difference in wing-pattern between the fore and hind wings.

DISTRIBUTION. Gabon.

Holotype ♂, GABON: Belinga, 900 m, Grande Crête Sud, 19.iii.1963 (G. Bernardi), in MBG, Paris.

Paratypes. GABON: Savanes de Mwadi, près du Iézé, 26.iii.1963 (G. Bernardi), 1 ♂; ibidem, 1.iv.1963, 1 ♂ (both MBG, Paris).

### *Zamarada carcassoni* sp. n.

(Text-figs 169, 170; Pl. 35, figs 591, 592; Pl. 94, fig. 835; Pl. 105, fig. 940)

♂ ♀ (Pl. 105, fig. 940). Hyaline area of wings greenish white (pl. 30, A2) slenderly edged distally with dark grey. Non-hyaline terminal area of wings brownish orange (pl. 6, C6) to light brown (pl. 6, D6), the dentate subterminal fascia marked in a shade darker and slenderly edged distally with silvery grey. Underside of non-hyaline terminal area of wings uniformly dark brown.

♂ genitalia (Text-figs 169, 170). Apex of dorsal margin of valve produced and serrate-edged; dorsal process dilate and setose at one-third; hair-scales of coremata light buff. Aedeagus with a projection at three-fourths, acicular in shape with ventral surface, next aedeagus, scobinate. Fulcrum tapered apicad with a pair of angular projections at two-thirds. Vesica with a slender, acicular cornutus.

♀ genitalia (Pl. 35, figs 591, 592). Sterigma with a digitate process extending anteriorly dorsad of the corpus bursae, the posterior half of which is sclerotized. Posterior margin of lamella postvaginalis asymmetrical.

Measurements. Fore wing: ♂ 14-15 mm; ♀ 15 mm. Antennal pectinations: ♂  $10 \times$ , ♀  $3 \times$  diameter of shaft.

Distinguished externally by the broader, warm brown, non-hyaline terminal area of the wings, less deeply penetrated by hyaline than in related species, combined with the uniformly dark brown of its under surface. Distinguished structurally in the male genitalia by the broad valve, by the length of the projection from the aedeagus and by the form of the fulcrum and in the female genitalia by the form of the sterigma and the extent of the sclerotization of the corpus bursae.

DISTRIBUTION. W. Uganda, Zaire.

Holotype ♂, UGANDA: Fort Portal, Mpanga Forest, v. 1958 (R. H. Carcasson), Geometridae genitalia slide no. 7034, in BMNH.

Paratypes. UGANDA: Bwamba, ii-iii. 1957 (*R. H. Carcasson*), 1 ♂ (BMNH), 1 ♂ (NMK, Nairobi); ibidem, v. 1958, 1 ♂ (BMNH), 1 ♂ (NMK, Nairobi); Toro, Bwamba, ix. 1961 (*N. Mitton*), 1 ♀ (BMNH); Toro, Kibale Forest, v. 1966 (*R. H. Carcasson*), 1 ♂ (NMK, Nairobi). ZAIRE ('Belgian Congo'): Uele, Paulis, 8.i.1958 (*Dr M. Fontaine*), 1 ♂ (MRAC, Tervuren).

It is with pleasure that I dedicate this species to my friend Mr R. H. Carcasson, whose careful collecting and generosity has enriched the collections of both the NMK, Nairobi and the BMNH.

### *Zamarada bernardii* sp. n.

(Text-figs 171, 172; Pl. 36, figs 593, 594; Pl. 105, fig. 944)

♂ ♀ (Pl. 105, fig. 944). Greyish yellow hyaline area of each wing extends to termen between veins  $M_3$  and  $Cu_{1b}$ . Non-hyaline terminal area of wings light brown (pl. 7, D6, Titian-red) slenderly edged distally with dark grey and suffused proximally with brownish grey (pl. 6, D2); broken, dentate subterminal fascia cinnamon-brown; cilia chequered grey and light yellow. Underside of non-hyaline terminal area of wings dark brown, apex of fore wing a little paler.

♂ genitalia (Text-figs 171, 172). Apex of dorsal margin and apical margin of valve angled at 90 degrees, smooth-edged. Aedeagus with a scobinate, acicular projection, similar to that of *carcassoni*. Margins of fulcrum crenulate at two-thirds.

♀ genitalia (Pl. 36, figs 593, 594). Similar to those of *carcassoni*, differing in the longer and more slender process extending anteriorly from the sterigma.

Measurements. Fore wing: ♂ 16 mm; ♀ 15 mm. Antennal pectinations: ♂ 8 ×, ♀ 3 × diameter of shaft.

The extension of the hyaline area to the termen on each wing, the form of its extension and the Titian-red colour of the non-hyaline terminal areas distinguish *bernardii* externally from related species.

DISTRIBUTION. Gabon, Cameroun.

Holotype ♂, GABON: Belinga, 500 m, 22.iii.1963 (*G. Bernardi*), in MBG, Paris.

Paratypes. GABON: Makokou, 500 m, 2.iii.1962 (*G. Bernardi*), 1 ♂ (MBG, Paris). CAMEROUN: Efulen, 10.vi.1922 (*H. L. Weber*), 1 ♀ (CM, Pittsburgh).

It is with pleasure that I dedicate this fine species to Dr G. Bernardi of the Muséum National d'Histoire Naturelle, Paris.

### *Zamarada antimima* sp. n.

(Text-figs 173, 174; Pl. 36, figs 595, 596; Pl. 105, fig. 942)

♂ ♀ (Pl. 105, fig. 942). Hyaline area of wings greyish yellow, as in *protrusa*, striate with brown, densely along posterior margin of fore wing, sparsely elsewhere and finely edged distally with black and silvery grey; the hyaline area extends almost to the termen between veins  $M_3$  and  $Cu_{1b}$ ; costa of fore wing and posterior margin of hind wing orange-grey striate with brown; discal spots minute, brown. Non-hyaline terminal area of wings orange-grey slenderly banded proximally and sparsely irrorate elsewhere with brownish grey (pl. 6, C2); cilia chequered buff and brownish grey. Underside of non-hyaline terminal area orange-white suffused proximally with brown in apical half of each wing.

♂ genitalia (Text-figs 173, 174). Differs from *protrusa* in the form of the truncate valve and in the presence on the aedeagus of a conspicuous, longitudinal, sclerotized ridge on its apical sixth. Differs from *bernardii* in the form of the aedeagus with its smooth rather than scobinate projection at two-thirds and in the presence of a sclerotized longitudinal ridge along the apical sixth.

♀ genitalia (Pl. 36, figs 595, 596). Closely similar to those of *protrusa*, differing in the broader, stouter process that extends anteriorly from the sterigma, dorsad of the corpus bursae; differing also in the more sharply defined sclerotized posterior half of the corpus bursae.

Measurements. Fore wing: ♂ 14–17 mm; ♀ 13.5 mm. Antennal pectinations: ♂ 10 ×, ♀ 4.5 × diameter of shaft.

Distinguished externally in the *protrusa*-group by the predominantly orange-grey colour of the non-hyaline terminal area, which is closely similar to that of the allopatric *pringlei* in the *excavata*-group; distinguished structurally from *protrusa* by the almost truncate valve in the male genitalia and by the asymmetrical posterior margin of the sterigma in the female genitalia.

DISTRIBUTION. Liberia, Ivory Coast, Nigeria, Cameroun, Gabon, Zaire.

Holotype ♂, CAMEROUN ('Kamerun'): Efulen, 11.ix.1922 (H. L. Weber), in CM, Pittsburgh.

Paratypes. LIBERIA: Nimba, Grassfield, vii–viii. 1967 (A. Forbes-Watson), 1 ♂ (NMK, Nairobi). IVORY COAST: Bingerville, 8.vi.1915 (G. Melou), 1 ♂ (BMNH); Lamto, 36 km N.N.W. of Tiassalé, 20–23.iv.1969 (C. Herbulot), 1 ♂; Yapo-Sud, 22 km S.S.E. of Agboville, 12–18.iv.1969 (C. Herbulot), 1 ♂ (both coll. Herbulot, Paris). NIGERIA: Warri, iv. 1897 (Dr Roth), 2 ♂ (BMNH). CAMEROUN: Efulen (H. L. Weber), 1 ♂; ibidem, 31.iii.1921, 1 ♀; 3.vi.1922, 1 ♂; 30.x.1924, 1 ♂; 15.xi.1922, 1 ♂; 19.xi.1920, 1 ♂; 16.xii.1921, 1 ♂ (all CM, Pittsburgh); Efulen (Epulan), 16.iv.1926 (G. Schwab), 1 ♂ (BMNH); Lolodorf, 11.xii.1914 (J. A. Reis), 1 ♂ (CM, Pittsburgh); Lolodorf, 1894–1895 (L. Conradt), 1 ♂ (BMNH); 8 km N. d'Edea, 10.iv.1970 (C. Herbulot), 1 ♂; N'Kongsamba, 5.iv.1958 (P. Darge), 1 ♀; Douala, ii. 1954, 1 ♂ (all coll. Herbulot, Paris). GABON: Savanes de Mwadi, près du Iézé, 26.iii.1963 (G. Bernardi), 1 ♂; Belinga, Camp Central, 500 m, 3.iv.1963 (G. Bernardi), 1 ♀ (both MBG, Paris); Abanga, 24.xi.1968 (P. Darge), 1 ♂ (coll. Herbulot, Paris). ZAIRE ('Belgian Congo'): Sankaru, Lusambo, 14.viii.1950 (Dr Fontaine), 1 ♂; Uele, Bambesa, 20.ix.1933 (J. Leroy), 1 ♂ (both MRAC, Tervuren).

### *Zamarada strigilecula* sp. n.

(Text-figs 175, 176; Pl. 37, figs 597, 598; Pl. 106, fig. 946)

♂ genitalia (Text-figs 175, 176). Dorsal third of valve sclerotized, apex tapered; apical half of sclerotized area coarsely scobinate; dorsal process dilate and setose at one-third; hair-scales of coremata light buff. Aedeagus with a thorn-like projection at two-thirds. Fulcrum tapered and strongly sclerotized. Vesica with a stout, thorn-like cornutus.

♀ genitalia (Pl. 37, figs 597, 598). Posterior margin of lamella postvaginalis symmetrical, bilobate. Posterior margin of lamella antevaginalis asymmetrical, the digitate process extending posteriorly at the right side longer and more slender than that from the left; left anterior margin with a short, broad, digitate projection. Posterior third of corpus bursae sclerotized, with a smooth, almost triangular projection at the left side.

Colour and pattern of upper surface of wings (Pl. 106, fig. 946) closely similar to those of *protrusa serrula*, differing in the rather less extensive penetration of hyaline into the non-hyaline terminal area of the wings between veins  $M_3$  and  $Cu_{1b}$ . Underside of non-hyaline terminal area of wings dark brown; apices of fore and hind wings light buff, tornus of fore wing, termen and posterior margin of hind wing buffish brown.

Measurements. Fore wing: ♂ 15 mm; ♀ 13 mm. Antennal pectinations: ♂ 8 ×, ♀ 3 × diameter of shaft.

Most surely distinguished from *protrusa serrula* by the very distinct form of the valve in the male genitalia and by the form of the sterigma and corpus bursae in the female genitalia.

DISTRIBUTION. Zaire.

Holotype ♂, ZAIRE ('Belgian Congo'): Ukaturaka (1°56' N. 20°24' E.), 29.xii.1948 (T. Wikeley), Geometridae genitalia slide no. 5993, in BMNH.

Paratype. 1 ♀ taken with holotype.

### *Zamarada ferruginata* sp. n.

(Text-figs 177, 178; Pl. 106, fig. 945)

♂ (Pl. 106, fig. 945). Non-hyaline terminal area of wings light orange (pl. 5, A4) irrorate with greyish brown (pl. 5, D3), lightly on veins, but densely proximad forming a band bordering the hyaline area; dentate and broken subterminal fascia brown (pl. 6, D7, raw sienna). Underside of non-hyaline terminal area of each wing light orange suffused with brown proximally, bordering the hyaline area. First abdominal segment with a white spot medio-dorsally.

♂ genitalia (Text-figs 177, 178). Valve of even width to broadly rounded apex; apex of dorsal margin produced in acicular form and inclined towards uncus, its surface minutely scobinate; dorsal process dilate and setose in basal third; hair-scales of coremata light buff. Aedeagus finely tapered apicad with an acicular projection from two-thirds. Apical half of fulcrum slender, smooth and tapered. Vesica with a short, thorn-like cornutus.

♀ unknown.

Measurements. Fore wing: ♂ 13 mm. Antennal pectinations: ♂ 8 × diameter of shaft.

Readily distinguished externally by colour and wing pattern and structurally by the form of the valve and of the aedeagus in the male genitalia.

DISTRIBUTION. Cameroun, Gabon.

Holotype ♂, GABON: Belinga, Camp Central, 500 m, 22.iii.1963 (G. Bernardi), in MBG, Paris.

Paratypes. GABON: Belinga, Camp Central, 700 m, 14.v.1963 (G. Bernardi), 2 ♂ (MBG, Paris). CAMEROUN: south, Efulen (Epulan), 10.iv.1926 (G. Schwab), 1 ♂ (BMNH).

### *Zamarada arguta* sp. n.

(Text-figs 179, 180; Pl. 37, figs 599, 600; Pl. 106, fig. 952)

♂ ♀ (Pl. 106, fig. 952). Non-hyaline terminal area of each wing light orange (pl. 5, A4) irrorate with light brown (pl. 6, D6, cinnamon), lightly distad of subterminal fascia, densely



proximad of it; subterminal fascia cinnamon-brown and sharply dentate, the points extending along the irrorate veins to form streaks to termen; the fascia is edged distally between the tooth-like markings with light buff to white; posterior margin of fore wing and large discal spot on each wing cinnamon-brown. Underside: non-hyaline terminal area light buff to light orange, fore wing suffused with light brown proximally, hind wing suffused with light brown between costa and vein  $M_3$  only; discal spots light brown.

♂ genitalia (Text-figs 179, 180). Similar to those of *ferruginata*, differing in the appreciably broader valve and the shorter, bifurcate extension from the apex of the dorsal margin.

♀ genitalia (Pl. 37, figs 599, 600).

Measurements. Fore wing: ♂ ♀ 15–16 mm. Antennal pectinations: ♂  $9 \times$ , ♀  $4 \times$  diameter of shaft.

The strongly marked, dentate subterminal fascia with its well contrasted, pale distal border and the large discal spots readily distinguish *arguta* from *ferruginata* and related species. Distinguished structurally by the male genitalia, as indicated; the female of *ferruginata* is not yet known.

DISTRIBUTION. Zaire, Zambia.

Holotype ♂, ZAIRE ('Belgian Congo'): Elisabethville, ix. 1950 (C. Seydel), in MRAC, Tervuren.

Paratypes. ZAIRE ('Belgian Congo'): Elisabethville, 17.iv.1955 (C. Seydel), 1 ♀; ibidem, 19.iv.1955, 1 ♂; 21.iv.1955, 2 ♂; 13.v.1955, 1 ♂; 10.iv.1951, 1 ♀ (all BMNH). ZAMBIA: Abercorn, xi. 1963 (D. Vesey-Fitzgerald), 1 ♂ (NMK, Nairobi).

### *Zamarada dentigera* Warren

(Text-figs 181–186; Pl. 38, figs 601, 602; Pl. 106, figs 949, 950)

*Zamarada dentigera* Warren, 1909 : 114.

♂ genitalia (Text-figs 181–186). Dorsal margin of valve slenderly sclerotized and smooth, apex produced to fine point and inclined towards uncus; dorsal process with setose projection at one-third; hair-scales of coremata light buff. Aedeagus tapered apicad; a short, bifurcate projection at three-fourths. Fulcrum broad, bilobate at apex, below which is a pair of short, rounded projections. Vesica without cornutus.

♀ genitalia (Pl. 38, figs 601, 602). There does not appear to be any corresponding geographical variation in the female genitalia.

Measurements. Fore wing: ♂ 12–16 mm; 12.5–15.0 mm. Antennal pectinations: ♂  $9 \times$ , ♀  $3 \times$  diameter of shaft.

The above ♂ description is based on the genitalia of the lectotype from Lagos, matched by other Nigerian specimens (Text-fig. 183).

Specimens from Ghana, Ivory Coast and Guinea differ in the form of the projection from three-fourths aedeagus (Text-fig. 184).

Text-figs 181, 182 represent the holotype of *polymnia* Oberthür from Cameroun, which is matched by examples from Angola, Kivu and W. Uganda; in the genitalia of these examples the projection from three-fourths aedeagus is simple and the fulcrum differs in being broadly rounded instead of bilobate at apex.

In examples from E. Kenya, Tanzania and Malawi the projection from the aedeagus approaches in form that of the lectotype of *dentigera*, but is distinct

(Text-fig. 185); in the population from Amani in Tanzania, the fulcrum is bilobate at apex (Text-fig. 186), in the other examples it is rounded.

DISTRIBUTION. Equatorial Africa.

Two subspecies are recognized, distinguished by the colour, pattern and width of the non-hyaline terminal area of the wings.

***Zamarada dentigera dentigera* Warren**

(Text-figs 181-185; Pl. 106, fig. 949)

*Zamarada dentigera* Warren, 1909 : 114. LECTOTYPE ♂, NIGERIA (BMNH), here designated [examined]

*Zamarada polymnia* Oberthür, 1912 : 259, 350, pl. 152, fig. 1463. Holotype ♂, CAMEROUN (BMNH) [examined].

*Zamarada dentigera* Warren; Herbulot, 1954 : 327.

♂ ♀ (Pl. 106, fig. 949). Hyaline area of wings tinged with greenish yellow, sparsely irrorate with brown and finely edged distally with dark brown to black; costa of fore wing and posterior margin of each wing yellowish brown irrorate with black; discal spots black. Non-hyaline terminal area of wings yellowish brown; subterminal fascia sharply marked and acutely dentate, extending unbroken on each wing from costa to posterior margin, orange-brown mixed with dark brown, each terminally inclined dentation reaching slender orange-brown terminal line; each wing clear yellowish brown distad of subterminal fascia; proximad of it, irrorate with dark brown and black, as illustrated. Measured at costa of fore wing the proportion of non-hyaline to hyaline areas varies from 5 : 11 to 5 : 13. Underside of non-hyaline terminal area of wings dark brown proximally, very light brown distally.

DISTRIBUTION. Guinea, Ivory Coast, Ghana, Nigeria, Cameroun, Gabon, Angola, Zaire, Uganda, Kenya, Malawi, Mozambique, Natal.

**MATERIAL EXAMINED.**

*Zamarada dentigera* Warren, lectotype ♂ here designated, NIGERIA ('West Africa'): Lagos, '*Zamarada dentigera* Warr. Type ♂' [in Warren's hand-writing]: Geometridae genitalia slide no. 6014, in BMNH. *Zamarada polymnia* Oberthür, holotype ♂, CAMEROUN ('Afriq. Occid.'): Johann-Albrechts Höhe, Station Kamerun, 1898 (*L. Conradt*), Geometridae genitalia slide no. 6016, in BMNH.

GUINEA: Boukouni Nr Macenta, 1750 ft, 11.v.1926 (*C. L. Collenette*) 1 ♂ (BMNH); Mt Nimba, 550 m, 1-17.x.1951 (*M. Lamotte et R. Roy*), 4 ♂ (MNHN, Paris). IVORY COAST: Bingerville, 11-15.ix.1915 (*G. Melou*), 1 ♂ (BMNH); Yapo-Sud, 22 km S.S.E. of Agboville, 12-18.iv.1969 (*C. Herbulot*), 1 ♂; Lamto, 36 km N.N.W. of Tiassalé, 20-23.iv.1969 (*C. Herbulot*), 1 ♂ (both coll. Herbulot, Paris). GHANA: Tarkwa, 1911, 1 ♂; Bibiani (Bibianaha), 700 ft, xii. 1911 (*H. G. F. Spurrell*), 1 ♂. NIGERIA: Lagos, 1 ♀ (*Zamarada dentigera* Warren, paralectotype, without abdomen); Mambilla Plateau, Karmantan Forest, 5500 ft, 10.xii.1968 (*H. Roberts*), 1 ♂ (IAR, Zaria). CAMEROUN: Johann-Albrechts Höhe, 1898 (*L. Conradt*), 1 ♂, 1 ♀ (BMNH); N'Kongsamba, 1.v.1958, 1 ♀; N'Kolbisson, 20.ii.1970, 1 ♂; Route Buea-V.H.F., 900 m, 25.x.1970, 1 ♂ (all *P. Darge*, in coll. Herbulot, Paris). GABON: Mouila, 25.ix-20.x.1964 (*P. Darge*), 3 ♂ (coll. Herbulot, Paris); Belinga,

Grande Crête Sud, 900 m, 19.iii.1963 (*G. Bernardi*), 1 ♂ (MBG, Paris). ANGOLA: Fazenda Congulu, Amboim district, 7–800 m, 12–16.iv.1934 (*Dr K. Jordan*), 2 ♂ (BMNH). ZAIRE ('Belgian Congo'): Kasai, Lodja, iii. 1959 (*R. H. Carcasson*), 1 ♀ (NMK, Nairobi); Kivu, Rwankwi, ix. 1947 (*J. V. Leroy*), 1 ♂; Ruwenzori, 18–20.vi.1950 (*H. B. D. Kettlewell*), 1 ♂. RWANDA: Lake Tshohoa, viii (*T. A. Barns*), 1 ♂ (all BMNH). UGANDA: Ankole, Kalinzu Forest, xi. 1961 (*R. H. Carcasson*), 1 ♂; Bwamba, vi. 1956 (*N. Mitton*), 1 ♂; Toro, Kibale Forest, v. 1966 (*R. H. Carcasson*), 1 ♂ (all NMK, Nairobi); Albert Nyanza, Butiaba Bay, 2028 ft, 3.ix.1928 (*Capt. Pitman*), 1 ♂ (BMNH); Entebbe, Zika Forest, 11.iv.1961, 1 ♂; ibidem, vii. 1961, 1 ♂ (both NMR, Bulawayo); Kampala, 3.ii.1955 (*D. G. Sevastopulo*), 1 ♂ (BMNH); W. Mengo, Kyadondo, ii, v.1958 (*J. Bowden*), 2 ♂ (ARS, Kawanda); ibidem, xii, i (*D. N. McNutt*), 2 ♂ (BMNH). KENYA: Kakamega Forest, iii. 1966 (*R. H. Carcasson*), 1 ♂ (NMK, Nairobi); Kakamega Forest, 5200 ft, 10–13.vii.1960 (*A. C. Twomey*), 1 ♂ (CM, Pittsburgh); Shimba Hills, xii. 1961 (*R. H. Carcasson*), 1 ♂ (BMNH). MALAWI: Mkuwadzi Forest, Nkata Bay, 4–8.viii.1956, 2 ♂, 1 ♀ (NMR, Bulawayo). MOZAMBIQUE: Chiluvo Hills, 2.xi.1963, 1 ♀; ibidem, Vila Machado, 30.x.1967 (*E. Pinhey*), 2 ♂; Serra Rotanda, E. of Chimanimani Mts., 1.iii.1970 (*E. Pinhey*), 1 ♀ (all NMR, Bulawayo). NATAL: St. Lucia Bay, vi. 1954 (*H. Cookson*), 1 ♂ (BMNH).

### *Zamarada dentigera stenotes* subsp. n.

(Text-fig. 186; Pl. 106, fig. 950)

♂ ♀ (Pl. 106, fig. 950). Distinguished from the nominate subspecies by the narrower non-hyaline terminal area of the wings; measured at costa of fore wing, the proportion of non-hyaline to hyaline areas varies from 4 : 14 to 4 : 15. The light straw ground colour is paler than that of the nominate subspecies, the dark irroration is blacker and more intense; the subterminal fascia is broken and ill-defined, only the innermost of the three lines is clearly indicated, the outermost rarely reaches the slender, black, terminal line. Underside of non-hyaline terminal area correspondingly narrower than in the nominate subspecies, blackish brown proximally, light brown to buff terminally.

DISTRIBUTION. Tanzania, E. Usambara Mts.

Holotype ♂, TANZANIA: Amani, xi. 1962 (*G. Pringle*), in BMNH.

Paratypes. TANZANIA: Amani, iii. 1962 (*G. Pringle*), 1 ♂; ibidem, iv. 1962, 1 ♂; ix. 1962, 1 ♂; xii, 2 ♀; without date, 2 ♂ (all BMNH); E. Usambara Mts., Amani, ii. 1953 (*E. Pinhey*), 1 ♂; ibidem, xi. 1965 (*R. H. Carcasson*), 2 ♂ (NMK, Nairobi).

### *Zamarada chrysopa* sp. n.

(Text-figs 187, 188; Pl. 38, figs 603, 604; Pl. 106, fig. 951)

♂ ♀ (Pl. 106, fig. 951). Closely related to *dentigera* and externally similar to its nominate subspecies. Differs on the upperside of the wings in the deeper, narrower penetration of hyaline into the terminal area, with the consequent interruption of the acutely dentate sub-terminal fascia, in the absence of dark brown and black irroration and in the presence of larger,

distinctly ringed discal spots. Differs markedly on the underside of the wings in the reduction of the dark brown of the non-hyaline terminal area to a slender shade bordering the hyaline area on the fore wing between the costa and vein  $M_3$  and between vein  $Cu_{1b}$  and the posterior margin; the remainder of the non-hyaline area of the wings is pale yellowish brown.

♂ genitalia (Text-figs 187, 188). Differ from those of *dentigera* in the presence of a serrate ridge along the apical fourth of the dorsal margin of the valve, in the bifurcate form of the projection at two-thirds aedeagus, arising nearer base than in *dentigera*, and in the almost simple fulcrum.

♀ genitalia (Pl. 38, figs 603, 604). Distinguished from *dentigera* by the more extensively sclerotized corpus bursae.

Measurements. Fore wing: ♂ ♀ 14.5 mm. Antennal pectinations: ♂ 9 ×, ♀ 3.5 × diameter of shaft.

DISTRIBUTION. Zaire, Katanga; E. Kenya.

Holotype ♂, ZAIRE ('Belgian Congo'): Haut Katanga, Shinkolobwe (Chinkolobwe) [11°02' S. 26°35' E.], 27.ix.1930, Geometridae genitalia slide no. 7075, in BMNH.

Paratypes. ZAIRE ('Belgian Congo'): Ht. Katanga, Shinkolobwe, 19.ii.1930 (*J. Romieux*), 1 ♂ (MHN, Geneva); Midingi, 18.vi.1930, 1 ♀ (BMNH).

Three specimens from coastal forests of Kenya are associated with *chrysopa*, but excluded from the type-series. A specimen from Nyali is more broadly and darkly marked with vinaceous grey immediately distad of the hyaline area than in the typical pair; structurally it is identical with the holotype.

Two specimens from Sokoce Forest, 8 miles south of Malindi, are smaller, having a fore wing length of 13 mm and have minute, uniformly dark discal spots. In the genitalia of one example the projection from two-thirds aedeagus, bifurcate in the holotype and in the Nyali specimen, is truncate and in the other specimen tapered and blade-like.

The larva of the reared specimen from Sokoce Forest was found on the foliage of *Ochna* sp. (Ochnaceae), but pupated without feeding further; *Ochna* may not be the host-plant.

KENYA: Nyali, 5.vii.1970 (*D. G. Sevastopulo*), 1 ♂; Sokoce Forest, 22.iv.1969, bred (*D. G. Sevastopulo*), 1 ♂ (both BMNH); Sokoce Forest, *Brachystegia*, 8 miles S. of Malindi, iv. 1969 (*M. Clifton*), 1 ♂ (NMK, Nairobi).

### *Zamarada fibulata* sp. n.

(Text-figs 189, 190; Pl. 39, figs 605, 606; Pl. 106, fig. 953)

♂ ♀ (Pl. 106, fig. 953). Hyaline area of wings green-tinged, sparsely irrorate with brown and finely edged distally with yellow and dark brown. Non-hyaline terminal area light brown (pl. 6, D5) irrorate with a darker shade of brown (pl. 6, E5); dentate subterminal fascia strongly marked, a darker shade of brown, finely edged distally with buff. Underside of non-hyaline terminal area of wings uniformly dark brown.

♂ genitalia (Text-figs 189, 190). Aedeagus tapered with a thorn-like projection at two-thirds. Fulcrum broadened asymmetrically apicad, extending beyond and enfolding tip of aedeagus; apex with two unequal projections, each with a short, thorn-like tip.

♀ genitalia (Pl. 39, figs 605, 606). Sterigma complex with two asymmetrical projections, serrate-edged on their apical margins, extending posteriorly ventrad of a sclerotized plate, the posterior margin of which is scalloped and serrate.



Measurements. Fore wing: ♂ 12 mm; ♀ 13 mm. Antennal pectinations: ♂ 9 ×, ♀ 4 × diameter of shaft.

Closely similar in colour and pattern to *subinterrupta* Gaede in the *excavata*-group. Differs in the slightly greater extension of the hyaline area towards the tornus on the fore wing and towards the anal angle on the hind wing and in the uniformly brown non-hyaline terminal area on the underside of each wing; differs further from *subinterrupta* in the male in having a simple, non-dilate hind tibia. In the male genitalia the form of the fulcrum and in the female the form of the complex sterigma are diagnostic.

DISTRIBUTION. Angola, Zaire.

Holotype ♂, ANGOLA: Quiculungo, 120 km N. of Lucala, 800 m, iv. 1936 (*R. Braun*), Geometridae genitalia slide no. 7141, in BMNH.

Paratypes. ZAIRE ('Belgian Congo'): Lindi-Tshopo Watershed, South of Makala, 2500 ft, viii. 1921 (*T. A. Barns*), 1 ♂; Kasai, Lodja, iii. 1959 (*R. H. Carcasson*), 1 ♀.

### *Zamarada urania* Oberthür

(Text-figs 191, 192; Pl. 39, figs 607, 608; Pl. 107, fig. 964)

*Zamarada urania* Oberthür, 1912 : 259, 350, pl. 152, fig. 1465. Holotype ♂, CAMEROUN (BMNH) [examined].

♂ ♀ (Pl. 107, fig. 964). Hyaline area of wings yellowish grey slenderly edged distally with black; discal spots dark grey, large on fore wing. Non-hyaline terminal area of each wing purplish grey irrorate with dark grey distad of the subterminal fascia, which is brown edged distally with light yellow and broken into irregular interneural spots; cilia chequered light yellow and dark grey. Underside of non-hyaline terminal area of wings uniformly brownish grey; cilia as upperside.

The hind tibia in the male has a tuft of short hair-scales, equal in length to width of tibia, probably best discernible in slide-mounted specimens.

♂ genitalia (Text-figs 191, 192). Apex of valve tapered and inclined towards uncus, apical area triangular in shape; hair-scales of coremata black. Apex of aedeagus slightly sinuous and tapered with a short, digitate projection at three-fourths. Fulcrum sinuous, dilate apicad with two angular projections from just below apex. Vesica with a scobinate, tapered cornutus.

♀ genitalia (Pl. 39, figs 607, 608).

Measurements. Fore wing: ♂ 12.5 mm; ♀ 12 mm. Antennal pectinations: ♂ 9 ×, ♀ 1.5 × diameter of shaft

Distinguished externally from other species in the *protrusa*-group by the shallow intrusion of hyaline into the non-hyaline terminal area of each wing and by the large discal spot on the fore wing. In the male genitalia the form of the valve and the presence of a scobinate cornutus and in the female the form of the very small and simple sterigma and the extent of the sclerotization of the corpus bursae are diagnostic.

DISTRIBUTION. Cameroun, Gabon.

## MATERIAL EXAMINED.

*Zamarada urania* Oberthür, holotype ♂, CAMEROUN ('Kamerun'): Lolodorf, 1894-1895 (*L. Conradt*), Geometridae genitalia slide no. 6020, in BMNH.

GABON: Makokou, 500 m, 19.iv.1963, 1 ♂; Belinga, Piste de Mwadi, 800 m, 20.iii.1963, 1 ♂, 1 ♀; Crête Sud, 900 m, 29.iii.1963, 1 ♀ (all *G. Bernardi*, in MBG, Paris).

*Zamarada melanopyga* Herbulot

(Text-figs 193, 194; Pl. 40, figs 609, 610; Pl. 106, fig. 948)

*Zamarada melanopyga* Herbulot, 1954 : 326, pl. 1. fig. 12, text-fig. 14. Holotype ♂, GUINEA (MNHN, Paris) [examined].

♂ ♀ (Pl. 106, fig. 948). Hyaline area of wings greyish yellow. Non-hyaline terminal area of wings light brown (pl. 6, D5-6); subterminal fascia brown (pl. 6, E6, cocoa-brown) edged distally with light buff, dentate and extending directly from costa to vein  $M_3$  on each wing and then from vein  $Cu_{1b}$  to posterior margin; cilia chequered grey and dull yellow. Underside of non-hyaline terminal area of wings uniformly dark brown. Tip of male abdomen dark grey.

♂ genitalia (Text-figs 193, 194). Dorsal margin of valve slenderly sclerotized, apex produced in digitate form, two-thirds as long as uncus; dorsal process boldly curved through 90 degrees, short, not extending beyond level of uncus, with a blunt, setose projection at one-third; hair-scales of coremata black. Aedeagus tapered finely. Fulcrum sinuous with a pair of angular projections at three-fourths. Vesica with two cornuti, one hook-shaped, one slender and scobinate.

♀ genitalia (Pl. 40, figs 609, 610).

Measurements. Fore wing: ♂ 10.5-13.0 mm; ♀ 11.5-13.0 mm. Antennal pectinations: ♂ 9 ×, ♀ 4 × diameter of shaft.

Differs externally from the closely similar *subinterrupta* Gaede in the *excavata*-group in the uniformly dark brown underside of the non-hyaline terminal area of the wings, lacking the pale apical area found on the fore wing of that species; differs further in the male in the dark grey terminal segments of the abdomen and in the presence of a simple hind tibia. The form of the valve with the slenderly produced apex of the dorsal margin and of the two cornuti in the male genitalia and the form of the sterigma in the female genitalia are diagnostic.

DISTRIBUTION. West Africa, Guinea to Angola, Zaire, W. Uganda.

## MATERIAL EXAMINED.

*Zamarada melanopyga* Herbulot, holotype ♂, GUINEA ('Guinée'): Mt. Nimba, 30.ix.1951 (*M. Lamotte et R. Roy*), in MNHN, Paris.

GUINEA: Mt. Nimba, 550 m, viii. 1951 (*M. Lamotte et R. Roy*), 1 ♂; ibidem, 1-20.x.1951, 5 ♂, 5 ♀ (MNHN, Paris, IFAN, Dakar, coll. Herbulot, Paris); Beyla (*Dr Mir. Mrázek*), 1 ♂ (MM, Brno); Macenta, 2000 ft, 2-21.v.1926 (*C. L. Collenette*), 1 ♀ (BMNH). SIERRA LEONE: Freetown, 8.x-19.xi.1968 (*D. F. Owen*), 1 ♀; Bambawo, 12.vi.1969 (*R. Revell*), 2 ♂. IVORY COAST: Bingerville, 14-20.vi.1915 (*G. Melou*), 1 ♂ (all BMNH); Yapo-Sud, 22 km S.S.E. of Agboville, 12-18.iv.1969

(*C. Herbulot*), 10 ♂, 6 ♀ (coll. Herbulot, Paris). GHANA: A'Koon, 1 ♀; Aburi, 2 ♂ (BMNH). NIGERIA: Mambilla Plateau, Karmartan Forest, 5500 ft (*H. Roberts*), 1 ♂ (IAR, Zaria); Warri, iv. 1897 (*Dr Roth*), 1 ♀ (BMNH). CAMEROUN: Efulen, iii, iv, vi (*H. L. Weber*), 4 ♂. GABON: Savanes Mwadi, près du Iézé, 26.iii.1963, 2 ♂; Crête Sud, 900 m, 19.iii.1963, 1 ♂; Camp Central, 700 m, 28.iii.1962, 1 ♂ (all *G. Bernardi*, in MBG, Paris); Mouila, ix, x. 1964 (*P. Darge*), 3 ♂ (coll. Herbulot, Paris). ANGOLA: Amboim district, Fazenda Congulu, 7-800 m, 7-11.iv.1934 (*Dr K. Jordan*), 1 ♂, 1 ♀. ZAIRE ('Belgian Congo'): Lindi-Tshopo Watershed, South of Makala, 2500 ft, viii. 1921 (*T. A. Barns*), 1 ♀ (BMNH). UGANDA: Toro, Bwamba, ix. 1961 (*N. Mitton*), 1 ♂ (NMK, Nairobi); Toro, Kibale Forest, v. 1966 (*R. H. Carcasson*), 1 ♀; Zika, 5.vi.1961 (*W. K. Brown*), 1 ♀ (BMNH); W. Mengo, Kyadondo, 3900 ft, 13.iv.1942 (*T. H. C. Taylor*), 1 ♀ (ARS, Kawanda).

### *Zamarada ostracodes* sp. n.

(Text-figs 195, 196; Pl. 40, figs 611, 612; Pl. 106, fig. 947)

♂ ♀ (Pl. 106, fig. 947). Differs externally from closely related *melanopyga*, with which it occurs in Cameroun, in the redder brown colour of the non-hyaline terminal area of the wings, which is brownish orange (pl. 6, C6, caramel-brown) instead of light brown.

♂ genitalia (Text-figs 195, 196). Differ from *melanopyga* in the form of the valve, with its less extensively produced apex, and in the vesica, which lacks the slender, scobinate cornutus of that species.

♀ genitalia (Pl. 40, figs 611, 612). Differ from *melanopyga* in the simpler sterigma and in the less extensively sclerotized corpus bursae.

Measurements. Fore wing: ♂ 12-13 mm; ♀ 12 mm. Antennal pectinations: ♂ 9 ×, ♀ 3 × diameter of shaft.

DISTRIBUTION. Uganda, Cameroun, Gabon.

Holotype ♂, UGANDA: Ankole, Kalinzu Forest, xi. 1961 (*R. H. Carcasson*), Geometridae genitalia slide no. 6902, in BMNH.

Paratypes. UGANDA: holotype data, 1 ♂ (NMK, Nairobi), 1 ♀ (BMNH). CAMEROUN: Savanes d'Akak, 14 km N.N.E. of Yaoundé, 20.ix.1971, 1 ♂; 8 km S. of Yaoundé, Mehandan, 17.i.1970, 1 ♂ (both *P. Darge*); 8 km N. d'Edea, 7.iv.1970 (*C. Herbulot*), 1 ♂ (all coll. Herbulot, Paris); Efulen, 27.i.1913 (*H. L. Weber*), 1 ♂; ibidem, v-vi, xi. 1922, 3 ♂ (all CM, Pittsburgh). GABON: Mouila, 5-30.ix.1964, 3 ♂; Franceville, 7.i.1964, 1 ♂ (all *P. Darge*, in coll. Herbulot, Paris).

### *Zamarada aglae* Oberthür

(Text-figs 197, 198; Pl. 41, figs 613, 614; Pl. 107, fig. 960)

*Zamarada aglae* Oberthür, 1912: 260, 350, pl. 152, fig. 1466. Holotype ♂, CAMEROUN (BMNH) [examined].

♂ ♀ (Pl. 107, fig. 960). Hyaline area of wings yellow sparsely irrorate along posterior margin of fore wing with purplish grey; costa of fore wing yellow; discal spots black, minute. Non-hyaline terminal area of wings purplish grey (pl. 13, D2) mixed with brownish orange;

dentate subterminal fascia dark brown slenderly edged proximally with reddish brown and distally with silvery grey from costa to vein  $M_3$  on each wing; posterior of vein  $Cu_{1b}$  subterminal fascia brownish orange; termen of each wing greyish yellow (pl. 4, B6, amber-yellow) between veins  $M_3$  and  $Cu_{1b}$ ; cilia chequered amber-yellow and purplish grey. Underside of non-hyaline terminal area of wings dark brown anterior of vein  $M_3$ , greyish orange suffused with dark brown posterior of it. Tip of male abdomen dark grey.

♂ genitalia (Text-figs 197, 198). Dorsal margin of valve narrowly sclerotized; apex of valve tapered and curved towards uncus. Aedeagus finely tapered. Fulcrum slightly sinuous, without projections. Vesica with two cornuti, one hook-like and strongly sclerotized, one weakly sclerotized and scobinate along one side.

♀ genitalia (Pl. 41, figs 613, 614). Lamella antevaginalis an almost rectangular plate, but with right posterior corner produced. Posterior margin of lamella postvaginalis irregularly crenulate. Corpus bursae strongly sclerotized and minutely scobinate posteriorly.

Measurements. Fore wing: ♂ 12–13 mm; ♀ 13 mm. Antennal pectinations: ♂ 7, ♀ 3 × diameter of shaft.

Distinguished externally by the presence of a slender amber-yellow band along the terminal area between veins  $M_3$  and  $Cu_{1b}$  on each wing. In the male genitalia the form of the tapered valve and of the cornuti and in the female the form of the sterigma are diagnostic.

DISTRIBUTION. Cameroun, Gabon.

#### MATERIAL EXAMINED.

*Zamarada aglae* Oberthür, holotype ♂, CAMEROUN ('Afriq. Occid.'): Johann-Albrechts Höhe, Station Kamerun, 1896 (*L. Conradt*), Geometridae genitalia slide no. 5995, in BMNH.

CAMEROUN: Lolodorf (*L. Conradt*), 2 ♂ (BMNH); Efulen, ii, v, vii, x, xi (*H. L. Weber*), 5 ♂ (CM, Pittsburgh). GABON: Belinga, Crête Sud, 900 m, 29.iii.1963, 1 ♂; Env. de Belinga, Savanes Mwadi, près du Iézé, 26.iii.1963, 2 ♂; Belinga, Camp Central, 700 m, 31.v.1963, 1 ♂; Rives de la Karagoua au nord du Mwadi, 24.v.1963, 1 ♂; Ivindo, 35 km au sud de Makokou, 24.iv.1963, 1 ♀ (all *G. Bernardi* in MBG, Paris and det. by C. Herbulot); Mouila, 5.ix.1964 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris).

#### *Zamarada ariste* sp. n.

(Text-figs 199, 200; Pl. 41, figs 615, 616; Pl. 107, fig. 957)

♂ ♀ (Pl. 107, fig. 957). Closely similar in colour and pattern to *aglae*; distinguished by its smaller size, by the presence of grey irroration in the hyaline area, especially its concentration at the middle of the posterior margin of the fore wing, and by the larger discal spot on the fore wing. The underside of the non-hyaline terminal area is more intensely greyish brown, markedly so at the tornus of the fore wing and the anal angle of the hind wing in the Cameroun specimens.

♂ genitalia (Text-figs 199, 200). Valve with weakly developed, longitudinal, medial ridge; a tapered, digitate projection, two-thirds as long as uncus, extends posteriorly from mid-apical margin. Aedeagus finely tapered to strongly sclerotized tip. Vesica scobinate medially and having a short, sinuous cornutus with a thorn-like tip.



♀ genitalia (Pl. 41, figs 615, 616). Lamella antevaginalis asymmetrical with a posteriorly inclined projection from the right side. Lamella postvaginalis with a pair of triangular plates, the apices extending posteriorly. Posterior third of corpus bursae sclerotized and scobinate medio-posteriorly.

Measurements. Fore wing: ♂ 10 mm; ♀ 10–11 mm. Antennal pectinations: ♂ 7 ×, ♀ 2.5 × diameter of shaft.

Distinguished structurally from both *aglae* and *phoenopasta* sp. n. in the male genitalia by the form of the valve with its tapered, digitate projection from the dorsal margin and in the female genitalia by the form of the sterigma.

DISTRIBUTION. Cameroun, Uganda.

Holotype ♂, CAMEROUN: 8 km N. d'Edea, 30.iii–1.iv.1970 (*C. Herbulot*), in coll. Herbulot, Paris.

Paratypes. CAMEROUN: holotype data, 3 ♀ (coll. Herbulot, Paris). UGANDA: Bwamba, vi. 1956 (*N. Mitton*), 1 ♀ (BMNH).

### *Zamarada phoenopasta* sp. n.

(Text-figs 201, 202; Pl. 42, figs 617, 618; Pl. 107, fig. 961)

♂ ♀ (Pl. 107, fig. 961). Wings closely similar in colour and pattern to those of *aglae* and *ariste*, differing in the greener-tinged hyaline area and its deeper penetration of the non-hyaline terminal area, reaching the termen between veins  $M_3$  and  $Cu_{1b}$ ; in the brownish orange subterminal fascia, edged distally with yellow and in the slight proximal diffusion of the purplish grey spots of the chequered cilia, where the hyaline area of the wing extends to the termen.

♂ genitalia (Text-figs 201, 202). Dorsal margin of valve narrowly sclerotized in basal three-fourths; apical fourth very weakly sclerotized, edge weakly serrate. Aedeagus dilate at two-thirds. Fulcrum sinuous, margins dilate at three-fourths. Vesica with a hook-like cornutus.

♀ genitalia (Pl. 42, figs 617, 618). Sterigma asymmetrical; lamella antevaginalis with a posteriorly inclined, blade-like projection at right side. Corpus bursae weakly sclerotized posteriorly.

Measurements. Fore wing ♂: 11–12 mm; ♀ 11 mm. Antennal pectinations: ♂ 10 ×, ♀ 4 × diameter of shaft.

In the male genitalia the weakly serrate apical fourth of the dorsal margin of the valve and in the female the form of the sterigma are diagnostic.

DISTRIBUTION. Uganda, Nigeria.

Holotype ♂, UGANDA: Toro, Kibale Forest, v. 1966 (*R. H. Carcasson*), Geometridae genitalia slide no. 7098, in BMNH.

Paratypes. UGANDA: holotype data, 1 ♂ (NMK, Nairobi), 1 ♀ (BMNH); Fort Portal, v. 1958 (*R. H. Carcasson*), 1 ♂; Ankole, Kalinzu Forest, v. 1961 (*T. H. E. Jackson*), 1 ♀ (both NMK, Nairobi); Kigezi, Kayonza (*T. H. E. Jackson*), 1 ♀ (BMNH). NIGERIA: Mambilla Plateau, Ngel Nyaki, montane forest, c. 5500 ft, 28.xi–3.xii.1968 (*J. Deeming*), 1 ♂ (BMNH).

*Zamarada cautela* sp. n.

(Text-figs 203, 204; Pl. 106, fig. 954)

♂ genitalia (Text-figs 203, 204). Apex of valve finely tapered and inclined towards uncus. Fulcrum narrowed at one-half, apical half smooth and of even width to slightly dilate tip. Vesica with a short, thorn-like cornutus, base scobinate at one side.

♀ unknown.

Measurements. Fore wing: ♂ 12–13 mm. Antennal pectinations: ♂  $8 \times$  diameter of shaft.

Closely similar in colour and pattern of upper and under surfaces of the wings (Pl. 106, fig. 954) to *melanopyga*; distinguished in the male genitalia by the tapered apex of the valve, by the form of the aedeagus and fulcrum and by the ornamentation of the vesica.

The male hind tibia is simple and the sole example in *cautela* has only one pair of spurs; the other hind tibiae have been lost. Should the structure of the hind tibia prove constant, the absence of its medial spurs would be a valuable diagnostic character.

DISTRIBUTION. Gabon.

Holotype ♂, GABON: Ivindo, 35 km au sud de Makokou, 2.v.1963 (*G. Bernardi*), in MBG, Paris.

Paratypes. GABON: Rives de la Karagoua au N. de Mwadi, 24.v.1963 (*G. Bernardi*), 1 ♂, in MBG, Paris; Abanga, 24.xi.1968 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris).

*Zamarada miranda* sp. n.

(Text-figs 205, 206; Pl. 109, fig. 983)

♂ (Pl. 109, fig. 983). Hyaline area of wings very weakly tinged with green and finely edged distally with dark brown; distal margin of fore wing straight, that of hind wing acutely angled distad between vein  $M_3$  and anal angle; fore wing striate proximally and along posterior margin with grey, vinaceous tinged in oblique light; costa buff, striate with silvery grey and brown; hind wing very sparsely irrorate with greyish brown, base of subcostal vein and posterior margin brown irrorate with greyish brown; discal spots greyish brown. Non-hyaline terminal area of each wing light brown (pl. 6, D6, cinnamon) patterned as illustrated with greyish brown (pl. 6, F3, negro). Underside of non-hyaline terminal area uniformly greyish brown.

♂ genitalia (Text-figs 205, 206). Closely similar to those of *cautela*, differing in the incurving towards the uncus through 90 degrees of the tapered apex of the valve and in the truncate, spatulate cornutus.

♀ unknown.

Measurements. Fore wing: ♂ 11 mm. Antennal pectinations: ♂  $6 \times$  diameter of shaft.

Strikingly distinct in colour and pattern, reminiscent only of the larger *herbuloti* sp. n. in the *aurolineata*-group.

DISTRIBUTION. Gabon.

Holotype ♂, GABON: Belinga, 900 m, Grand Crête Sud, 19.iii.1963 (*G. Bernardi*), in MBG, Paris.

### THE VIETTEI-GROUP

In habitus closely similar to many species in the *excavata* and *protrusa*-groups.

In the male genitalia the uncus is short, tapered and dorsally setose. Ventral plate of gnathus well developed and smooth, apex narrowly rounded. Valve weakly sclerotized, more strongly along ventral margin; dorsal process with large, setose projection at one-third. Aedeagus rounded at apex; an apically rounded, spatulate projection at four-fifths. Fulcrum strongly sclerotized, apex broadly asymmetrical and coarsely spined, a large spine at the right side. Vesica with a sinuous cornutus.

### *Zamarada viettei* sp. n.

(Text-figs 207, 208; Pl. 42, figs 619, 620; Pl. 100, fig. 899)

[*Comibaena reflexaria* Walker sensu Saalmüller, 1891 : 495, pl. 14, fig. 265. Misidentification.]

♂ ♀ (Pl. 100, fig. 899). Hyaline area of wings weakly tinged with greyish yellow, sparsely striate with grey that is vinaceous tinged in oblique light, and finely edged distally with brown; discal spots minute, jet-black. Non-hyaline terminal area greyish orange (pl. 5, B<sub>4</sub>) suffused with brownish grey (pl. 6, C<sub>2</sub>) proximad of the subterminal fascia, sometimes over the entire area in the female, the suffusion having a vinaceous tinge in oblique light; dentate subterminal fascia light brown (pl. 6, D<sub>6</sub>, cinnamon) finely edged distally with glossy buff, first tooth-mark on fore wing mixed with black; cilia chequered greyish yellow and grey. Underside of non-hyaline terminal area greyish orange suffused with dark grey in discal area of fore wing, sometimes densely over whole area in female.

Male hind tibia dilate with a tuft of hair-scales one-third as long as tibia.

♂ genitalia (Text-figs 207, 208). Described under species-group heading.

♀ genitalia (Pl. 42, figs 619, 620). Posterior margin of lamella antevaginalis irregularly dentate, but with smoothly edged medial excavation. Posterior margin of lamella postvaginalis irregularly crenulate. Corpus bursae very weakly sclerotized posteriorly and scobinate medially just anterior of operculum.

Measurements. Fore wing: ♂ 12–13 mm; ♀ 11.0–11.5 mm. Antennal pectinations: ♂ 15 ×, ♀ 7 × diameter of shaft.

Distinguished externally from similarly patterned *oxybeles* in the *excavata*-group and *calypso* in the *polycytemon*-group occurring in Madagascar by the almost colourless hyaline area of the wings and the smaller, smooth-edged excavations of the non-hyaline terminal area between veins  $M_3$  and  $Cu_{1b}$  on each wing. The male is further distinguished by the presence of a dilate, tufted hind tibia and by its longer antennal pectinations.

DISTRIBUTION. Madagascar.

Holotype ♂, MADAGASCAR: nord, Nossi-Bé, Forêt de Lokobe, Alt. 150 m, 3–9.xi.1958 (*P. Viette*), genitalia slide no. 4813, in MNHN, Paris.

Paratypes. Holotype data, 2 ♂, 2 ♀ (MNHN, Paris).

It is with pleasure that I dedicate this species to my friend Dr P. Viette of the Paris Museum, who collected the short type-series at Nossi-Bé.

### THE *CEPA*-GROUP

The sole species in the group is strikingly distinct in its large size and its colour and wing pattern. In the male the underside of the non-hyaline terminal area of the hind wing is densely clothed with specialized scales.

Characterized in the male genitalia by the bulbous form of the uncus and by the form of valve, in which there is a longitudinal medial ridge extending apicad to a cluster of coarse spines just below the truncate apex; the dorsal half of the valve is densely long-spined.

### *Zamarada cepa* sp. n.

(Text-figs 209, 210; Pl. 43, figs 621, 622; Pl. 108, figs 965, 968)

♂♀ (Pl. 108, figs 965, 968). Palpus, frons and head buff irrorate with brown. Patagia and tegulae light grey; remainder of thorax and dorsum light brown irrorate with a dark brown, a large white medio-dorsal spot on second abdominal segment, a small one on each of segments 3-6. Pectus and venter buff. Hyaline area of wings green, very sparsely striate with grey; discal spots minute, grey; costa of fore wing buff irrorate with grey; curved base of vein  $R_5$  on hind wing dark grey. Non-hyaline terminal area of wings greyish brown (pl. 6, D3) sparsely irrorate with dark brown; dentate subterminal fascia, diffuse proximad on hind wing, dark brown (pl. 6, F5) finely edged distally with white. Underside of non-hyaline terminal area of wings uniformly brown (pl. 6, E4) in female and on fore wing of male; on the male hind wing the area is densely clothed with specialized scales, dark brown tinged with buff proximally.

On the male hind leg the femur is fringed with long light buff hair-scales; the tibia is light buff and grossly dilate enclosing a dense tuft of dark grey hair-scales.

♂ genitalia (Text-figs 209, 210). Uncus bulbous. Slender arms of gnathus fused medially but not forming a ventral plate. Valve with longitudinal medial ridge extending apicad to a cluster of coarse spines just below truncate apex; dorsal half of valve densely long-spined; dorsal process with setose projection at one-third. Fulcrum smooth and evenly tapered, apex curved dorsad. Vesica with a broad-based, thorn-like cornutus.

♀ genitalia (Pl. 43, figs 621, 622). Lamella antevaginalis lobate, narrowly rounded and minutely scobinate posteriorly. Posterior margin of lamella postvaginalis irregularly crenulate; a small, globular projection, from which two parallel ridges extend anteriorly to fuse with lamella antevaginalis, is situate medially.

Measurements. Fore wing: ♂ 18.0-18.5 mm; ♀ 19 mm. Antennal pectinations: ♂ 9 ×, ♀ 4 × diameter of shaft.

Both sexes of this beautiful species are strikingly distinct in colour and pattern; the male is further distinguished by the presence of specialized scales on the underside of the non-hyaline terminal area of the hind wing.

DISTRIBUTION. Gabon.

Holotype ♂, GABON: Belinga, Savane ter. aviation, 500 m, 12.iii.1963 (G. Bernardi), in MBG, Paris.



Paratypes. GABON: Rives de la Karagoua au N. de Mwadi, 24.v.1963 (G. Bernardi), 1 ♂; Makokou, 18.xi.1967 (G. Bernardi), 1 ♀ (both MBG, Paris).

### THE XYSTRA-GROUP

Characterized in the male genitalia by the form of the valve, which is finely tapered to an acicular apex and which has a short spine-like projection from mid-dorsal margin and by the broad, deep and coarsely spined fultura superior. The form of the female genitalia with a digitate process extending anteriorly from the sterigma and the sclerotization of the posterior part of the corpus bursae suggest an affinity with the *excavata*-group.

### KEY TO SPECIES

- 1 Dorsal surface of uncus with a longitudinal, keel-like ridge. Aedeagus with digitate projection from two-thirds. Fulcrum dilate and spatulate at apex; apex truncate . . . . . *similis* (p. 127)
- Dorsal surface of uncus evenly curved. Aedeagus with thorn-like projection from three-fourths. Fulcrum scobinate in apical half, apex acicular . . . . . *xystra* (p. 126)

### *Zamarada xystra* sp. n.

(Text-figs 211, 212; Pl. 43, figs 623, 624; Pl. 107, fig. 962)

♂ ♀ (Pl. 107, fig. 962). Hyaline area of wings tinged with greyish yellow, striate with brown, densely along posterior margin of each wing, sparsely elsewhere, and finely edged distally with dark brown, then silvery grey; costa of fore wing buff, striate with grey; discal spots black, that of fore wing large and silvery grey at centre. Non-hyaline terminal area light brown (pl. 6, D5, sunburn-D6, cinnamon) densely irrorate with a darker shade (pl. 6, E6, cocoa-brown-E7); dentate subterminal fascia a darker shade of brown finely edged distally with silvery grey. Underside of non-hyaline terminal area uniformly greyish brown.

In the male all femora are fringed with long, light brown hair-scales; the hind tibia is grey, grossly dilate and encloses a dense tuft of short, grey hair-scales.

♂ genitalia (Text-figs 211, 212). Uncus bulbous, apical half tapered and curved ventrad. Valve finely tapered to acicular apex; a spine-like projection at mid-dorsal margin, a projection that may consist of one, two or three short spines; in some examples the projection is present on one valve only; dorsal process setose at one-third, but without pronounced projection; hair-scales of coremata buff. Aedeagus strongly sclerotized and tapered apicad with a thorn-like projection at three-fourths. Fulcrum strongly sclerotized and finely tapered with some scobination below tip. Vesica with a minute, thorn-like cornutus.

♀ genitalia (Pl. 43, figs 623, 624). Posterior margin of lamella antevaginalis bilobate; a hollow digitate process extends anteriorly from right side, which may perhaps accommodate the fulcrum during copulation. Corpus bursae sclerotized and minutely scobinate posteriorly.

Measurements. Fore wing: ♂ 16.5–17.0 mm; ♀ 15 mm. Antennal pectinations: ♂ 8 ×, ♀ 5 × diameter of shaft.

Distinct externally in colour and pattern. Distinguished from the following species, *similis*, by the darker brown colour of the non-hyaline terminal area,

comparable as plain chocolate to milk chocolate; distinguished from it in the male genitalia by the form of the uncus, aedeagus and fulcrum.

Reminiscent of the *dione*-group, but differing in its smaller size, appreciably less striate hyaline area and the presence of a sharply defined, black discal spot on the hind wing; further distinguished in the male by the fringed femora of all legs and by the grossly dilate hind tibia.

DISTRIBUTION. Cameroun.

Holotype ♂, CAMEROUN: Efulen, 29.v.1925 (*H. L. Weber*), in CM, Pittsburgh.

Paratypes. CAMEROUN: Efulen, 21.vi.1922 (*H. L. Weber*), 1 ♂, ibidem, 13.vii.1922, 1 ♂, 1 ♀; 12.x.1922, 1 ♂; 16.xii.1921, 1 ♂ (all CM, Pittsburgh); Efulen (Epulan), 12-15.iv.1926 (*G. Schwab*), 2 ♂ (BMNH); 8 km N. d'Edea, 30.iii-1.iv.1970 (*C. Herbulot*), 3 ♂; Massif du Manengouba, 5 km N.O. de N'Kongsamba, 1200 m., 2.iv.1970 (*C. Herbulot et C. Lemaire*), 1 ♂; N'Kongsamba, 5-8.iv.1970 (*P. Darge*), 2 ♂; ibidem, 14.v.1958, 1 ♂ (all coll. Herbulot, Paris); Johann-Albrechts Höhe, 29.v.1896 (*L. Conradt*), 1 ♂ (BMNH).

### *Zamarada similis* sp. n.

(Text-figs 213, 214; Pl. 107, fig. 963)

♂ (Pl. 107, fig. 963). Differs externally from the similarly patterned *xystra* with which it occurs in the brownish orange colour (pl. 6, C6, caramel-brown-C7, reddish golden) of the non-hyaline terminal area of the wing; the lighter brown of *similis* compared with the darker *xystra* is as milk chocolate to plain chocolate.

♂ genitalia (Text-figs 213, 214). Differs from the closely related *xystra* in the form of the uncus, which is strongly ridged dorsally in keel-like form and in the form of the aedeagus which has an apically rounded, digitate projection at two-thirds. The fulcrum is dilate and spatulate apicad; apex truncate.

♀ unknown.

Measurements. Fore wing: ♂ 16.5-18.0 mm. Antennal pectinations: ♂ 6.5 × diameter of shaft.

DISTRIBUTION. Cameroun, Zaire.

Holotype ♂, CAMEROUN: Efulen, 29.iv.1922 (*H. L. Weber*), in CM, Pittsburgh.

Paratypes. CAMEROUN: Efulen, 21.vi.1922 (*H. L. Weber*), 1 ♂ (CM, Pittsburgh). ZAIRE ('Belgian Congo'): Sankaru, Lusambo, 18.vi.1949 (*Dr M. Fontaine*), 1 ♂; ibidem, 1.ix.1950, 1 ♂ (both MRAC, Tervuren).

### THE *ILARIA*-GROUP

Externally reminiscent of *dentigera* and *arguta* in the *protrusa*-group, with which the *ilaria*-group appears to be related in the form of the uncus and the valve.

Characterized in the male genitalia by the very weakly sclerotized valve, which has a slender ridge in the apical half parallel with the ventral margin, and with a very weakly scobinate dorsal margin; by the form of the aedeagus, which in its apical two-thirds bears a slender, sclerotized ridge along one side, a thorn-like

laterally inclined projection at one-half, and by the form of the fulcrum, the apex of which is dilate and spatulate, the dorsal surface densely and coarsely scobinate and tipped with a stout spine equal in length to the width of the scobinate, pad-like apex.

In the female genitalia the sterigma is asymmetrical and laterally crenulate; the corpus bursae is wholly membranous.

#### KEY TO SPECIES

- 1 Ventral margin of valve curved apicad to right-angled apex of dorsal margin; maximum width of apical fourth of valve equal to one-third length of dorsal margin, from apex to base of dorsal process. Ratio of longest male antennal pectinations to diameter of shaft 6.5 : 0.5 . . . *ilaria* (p. 128)
- Apex of valve narrowly rounded; maximum width of apical fourth of valve equal to one-sixth of dorsal margin of valve from apex to base of dorsal process. Ratio of longest male antennal pectinations to diameter of shaft 10 : 0.7 . . . . . *erato* (p. 129)

### *Zamarada ilaria* Swinhoe

(Text-figs 215, 216; Pl. 44, figs 625, 626; Pl. 107, figs 955, 956)

*Zamarada ilaria* Swinhoe, 1904 : 516. Holotype ♂, SIERRA LEONE (BMNH) [examined].  
*Zamarada ilaria* Swinhoe; Herbulot, 1954 : 327.

♂ ♀ (Pl. 107, figs 955, 956). Non-hyaline terminal area of wings densely irrorate with light brown (pl. 6, D7, raw sienna) to brown (pl. 7, E6); basal area of fore wing at posterior margin and discal spot on each wing similarly coloured; dentate subterminal fascia on each wing a shade darker and slenderly edged distally with glossy greyish orange; cilia chequered greyish orange and dark grey. Underside of non-hyaline terminal area of wings: apical area of fore wing, from costa to vein  $M_1$ , white to light buff; remainder of wings greyish orange densely suffused with dark brown, as illustrated (Pl. 107, fig. 956).

In the male the hind tibia is dilate with a short buff hair-pencil.

♂ genitalia (Text-figs 215, 216). Arms of gnathus very short, connected medially by membrane. Juxta well developed. Ventral margin of valve curved apicad to right-angled apex of dorsal margin; dorsal process strongly setose; hair-scales of coremata light buff. Vesica without cornutus.

♀ genitalia (Pl. 44, figs 625, 626).

Measurements. Fore wing: ♂ ♀ 14–16 mm. Antennal pectinations: ♂ 13 × [6.5 : 0.5], ♀ 8 × diameter of shaft.

This and the following species, *erato*, were tentatively synonymized by Gaede (1915 : 116), though at the time he drew attention to the differences between the two in the colour of the underside of the wings.

In *ilaria* the non-hyaline area of the upperside of the wings is densely irrorate with brown (pl. 6, D7, raw sienna to pl. 7, E6); in *erato* this area is greyish orange (pl. 5, B6–7, apricot). The underside of the non-hyaline terminal area of the wings is more extensively suffused with dark brown than in *erato*.

Although the ratio of the longest pectinations to the diameter of the shaft appears to differ little between the males of the two species, the pectinations of

*ilaria* being  $13 \times$ , those of *erato* being  $14 \times$  the diameter of the shaft, the pectinations of *erato* are appreciably longer, its shaft being broader.

In the male genitalia *ilaria* is readily distinguished by the broader apex of the valve and the stouter thorn-like lateral projection from the aedeagus. The female genitalia of the two species do not appear to differ.

DISTRIBUTION. Guinea, Sierra Leone, Liberia, Nigeria, Cameroun.

#### MATERIAL EXAMINED.

*Zamarada ilaria* Swinhoe, holotype ♂, SIERRA LEONE: vi. 1895 (*W. G. Clements*), without abdomen, in BMNH.

GUINEA: Mt. Nimba, 17.x.1951 (*M. Lamotte et R. Roy*), 1 ♀ (IFAN, Dakar). SIERRA LEONE: Njala, v. 1934 (*E. Hargreaves*), 1 ♀; Freetown, 8.x-19.xi.1968 (*D. F. Owen*), 3 ♂, 2 ♀; ibidem, 24.xi-15.xii.1968, 5 ♂; Bo (*R. Revell*), 1 ♂. LIBERIA: Nimba, Grassfield, vi-vii. 1967 (*A. Forbes-Watson*), 1 ♂, 1 ♀. NIGERIA: Ikom, 20.ii.1930 (*E. F. G. Haig*), 1 ♂ (all BMNH). CAMEROUN: Efulen, v, vi, x-xii (*H. L. Weber*), 4 ♂, 2 ♀; Lolodorf, 29.xii.1913 (*A. I. Good*), 1 ♀ (all CM, Pittsburgh); Kribi, 1 ♀ (MNHU, Berlin).

#### *Zamarada erato* Oberthür sp. rev.

(Text-figs 217, 218; Pl. 107, figs 958, 959)

*Zamarada erato* Oberthür, 1912: 258, 350, pl. 152, fig. 1462. LECTOTYPE ♂, CAMEROUN (BMNH), here designated [examined].

*Zamarada erato* Oberthür; Gaede, 1915: 116.

♂ ♀ (Pl. 107, figs 958, 959). Differs externally from *ilaria* in the longer pectinations of the male antennae, in the paler, brighter, greyish orange colour of the non-hyaline area of the upperside of the wings and in the less extensive dark suffusion of the corresponding areas of the underside.

♂ genitalia (Text-figs 217, 218). Differ from those of *ilaria* in the narrowly rounded apex of the valve and in the reduced size of the thorn-like lateral projection from the aedeagus.

The female genitalia do not appear to differ from those of *ilaria*.

Measurements. Fore wing: ♂ ♀ 14-16 mm. Antennal pectinations: ♂  $14 \times$  [10:0.7], ♀  $8 \times$  diameter of shaft.

DISTRIBUTION. Cameroun.

#### MATERIAL EXAMINED.

*Zamarada erato* Oberthür, lectotype ♂, here designated, CAMEROUN ('Kamerun'): Lolodorf, 1894-1895 (*L. Conradt*), '*Zamarada Erato*, ♂, Obthr.' (in Oberthür's hand-writing): black and white outline copy of fig. 1462: Geometridae genitalia slide no. 6018, in BMNH.

CAMEROUN: lectotype data, 2 ♂, 7 ♀ (BMNH); Efulen, iii-vi, viii, xi, xii (*H. L. Weber*), 6 ♂, 3 ♀ (CM, Pittsburgh); Batanga, 1 ♂ (CM, Pittsburgh); S. Cameroons, 19.ii.1926 (*G. Schwab*), 1 ♀; ibidem, xi, 2 ♀ (both BMNH).



THE *GAEDEI*-GROUP

Characterized in the male genitalia by the form of the uncus, which has a waist-like constriction medially and at its base a pair of tapered lateral projections, and by the form of the dorsal process of the valve which is broadly dilate at one-third.

In the form of the valve and aedeagus evidently related to the *protrusa*-group. The female genitalia, with the small sterigma and sclerotized posterior third of the corpus bursae, show similar affinities.

*Zamarada gaedei* (Prout MS) sp. n.

(Text-figs 219, 220; Pl. 44, figs 627, 628; Pl. 108, figs 969, 972)

[*Zamarada polymnia* Oberthür sensu Gaede, 1915 : 116. Misidentification.]

♂ ♀ (Pl. 108, figs. 969, 972). Hyaline area of wings greyish yellow irrorate with greyish brown, lightly in male, very sparsely in female. Non-hyaline terminal area of each wing greyish orange (pl. 5, B6, apricot-yellow) suffused as illustrated with greyish brown (pl. 6, D3, café au lait), lightly in female (Pl. 108, fig. 972), strongly in male (Pl. 108, fig. 969); dentate subterminal fascia brownish orange finely edged distally with white, more contrastingly marked in male; cilia chequered greyish orange and greyish brown. In the male the eighth abdominal segment is glossy grey, the scales closely adpressed. Underside of non-hyaline terminal area of wings greyish orange, partially suffused with dark brown; in the male the apex and tornus of the fore wing are of the ground colour; in the female the apex and posterior fourth of the fore wing and the whole of the hind wing are of the ground colour.

In the male the hind tibia is simple.

♂ genitalia (Text-figs 219, 220). Arms of gnathus broad at base, tapered and weakly fused medially. Valve simple with rounded apex. Aedeagus tapered with one or two very small thorn-like projections at two-thirds. Fulcrum spatulate and rounded at apex, a pair of thorn-like projections at two-thirds. Vesica with a stout, tapered cornutus.

♀ genitalia (Pl. 44, figs 627, 628). Sterigma with two short, digitate processes extending posteriorly, one from the lamella antevaginalis, one from the lamella postvaginalis. Posterior third of corpus bursae sclerotized, remainder membranous with a circular, stellate signum.

Measurements. Fore wing: ♂ 15–17 mm; ♀ 14–15 mm. Antennal pectinations: ♂ 8 ×, ♀ 2.5 × diameter of shaft.

Distinct in the colour and pattern of the upper and under surfaces of the wings. In the male genitalia the form of the uncus, the dorsal process of the valve and the aedeagus and in the female genitalia the form of the sterigma are diagnostic.

DISTRIBUTION. Cameroun, Gabon.

Holotype ♂, CAMEROUN ('Kamerun'): Efulen, 16.xii.1921 (*H. L. Weber*), CM, Pittsburgh.

Paratypes. CAMEROUN: Efulen, 15.iii.1923 (*H. L. Weber*), 1 ♂; ibidem, 10.iv.1923, 2 ♀; 19.iv.1923, 1 ♂; 31.v.1922, 1 ♂; 2.v.1923, 1 ♀; 13.v.1923, 1 ♂; 18.v.1922, 1 ♀; 31.v.1922, 1 ♂; 10.vi.1922, 1 ♀; 21.vi.1922, 2 ♂; 26.vi.1922, 2 ♂; 16.viii.1922, 1 ♂; 13.ix.1922, 1 ♂; 7.x.1921, 1 ♀; 25.x.1924, 1 ♀; 9.xii.1922, 1 ♂; 13.xii.1922, 1 ♂; 16.xii.1921, 3 ♂, 2 ♀; 18.xii.1922, 1 ♂; 27.xii.1921, 1 ♀ (all CM,

Pittsburgh); Johann-Albrechts Höhe (*L. Conradt*), 1 ♂, 1 ♀ (BMNH); N'Kolbisson, 22.ii.1970 (*P. Darge*), 1 ♂ (coll. Herbulot). GABON: Belinga, Piste de Mwadi, 800 m, 20.iii.1953 (*G. Bernardi*), 2 ♂, 1 ♀ (MBG, Paris); Mouila, 5.x.1964 (*P. Darge*) 1 ♂ (coll. Herbulot, Paris).

### THE *POLYCTEMON*-GROUP

Characterized in the male genitalia by the form of the uncus, which is tapered in its apical half and which has two pairs of lateral projections, the posterior pair membranous and setose, the anterior pair sclerotized. The dorsal process of the valve is simple, without setose dilation or projection. The male hind tibia is simple.

#### KEY TO SPECIES

- |       |                                                                                                                                                                                                                                                                     |                              |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 1     | Fulcrum extending well beyond apex of aedeagus. Vesica without cornuti                                                                                                                                                                                              | 2                            |
| —     | Fulcrum not extending to level of apex of aedeagus. Vesica with a short, thorn-like cornutus                                                                                                                                                                        | 4                            |
| 2 (1) | Ventral plate of gnathus bifid. Apical fifth of valve tapered and slightly spiral, dorsal margin minutely scobinate apicad, ventral margin smooth. Distribution: S. Africa                                                                                          | <i>transvisaria</i> (p. 131) |
| —     | Ventral plate of gnathus rounded or truncate. Valve not so formed.                                                                                                                                                                                                  | 3                            |
| 3 (2) | Apical third of valve incurved towards uncus, ventral margin coarsely serrate. Distribution: Madagascar, Kenya Coast, Ethiopia                                                                                                                                      | <i>calypso</i> (p. 133)      |
| —     | Valve tapered to narrow, truncate apex, margins smooth; a longitudinal ridge extends from one-fourth to apex, ridge scobinate apicad. Distribution: Tanzania                                                                                                        | <i>amelga</i> (p. 133)       |
| 4 (1) | Hyaline area of wings wax-yellow, extending to termen between veins $M_3$ and $Cu_{1b}$ . Non-hyaline terminal area predominantly dark grey finely edged proximally with yellow. Discal spot on fore wing large, dark grey; discal spot on hind wing always present | <i>polyctemon</i> (p. 135)   |
| —     | Hyaline area of wings tinged with greyish yellow. Non-hyaline terminal area predominantly reddish grey, rarely extending to termen between veins $M_3$ and $Cu_{1b}$ . Discal spots small, usually present on fore wing only                                        | 5                            |
| 5 (4) | Hyaline area of wings extending to termen between veins $M_3$ and $Cu_{1b}$ . Discal spots present on both fore and hind wings. Distribution: Eritrea (Known from unique female only)                                                                               | <i>euryscaphes</i> (p. 135)  |
| —     | Hyaline area of wings approaching, but not extending to termen between veins $M_3$ and $Cu_{1b}$ . Discal spot usually absent from hind wing (absent in 27 of series of 37). Distribution: Kenya and Tanzania                                                       | <i>iobathra</i> (p. 134)     |

### *Zamarada transvisaria* (Guenée)

(Text-figs 221, 222; Pl. 45, figs 629, 630; Pl. 108, fig. 966; Map 3)

*Epione transvisaria* Guenée, 1857 : 98. Holotype ♀, SOUTH AFRICA (BMNH) [examined]. [*Comibaena reflexaria* Walker, [1863] 1862 : 1565. Paralectotype ♂. Misidentification].  
*Euchlovis exarata* Felder, 1875: pl. 127, fig. 8. LECTOTYPE ♂, SOUTH AFRICA (BMNH), here designated [examined].

*Epione transvisaria* Guenée; Oberthür, 1912 : 255, 350, pl. 152, fig. 1453, nec figs 1454, 1455.  
*Zamarada transvisaria* (Guenée) Oberthür, 1912 : 256, 257.

*Zamarada exarata* (Felder); Oberthür, 1912 : 257. [Tentative synonymy with *transvisata* [sic] Guenée.]

*Zamarada transvisaria* (Guenée); Janse, 1932 : 138, pl. 2, fig. 3, text-fig. 39.

♂♀ (Pl. 108, fig. 966). Hyaline area of wings finely edged distally with light brown; discal spots minute, grey to black. Non-hyaline terminal area, deeply excavate between veins  $M_3$  and  $Cu_{1b}$ , greyish orange lightly irrorate with brownish orange, except in discal area of fore wing where the irroration is dense. Underside of non-hyaline terminal area similar to that of upperside.

Variable in colour; in some examples the hyaline area is tinged strongly with green, in others faintly with greyish yellow. The non-hyaline terminal area in some forms is grey, in others varying shades of brown; the dentate subterminal fascia is often marked sharply and edged distally with pale grey.

♂ genitalia (Text-figs 221, 222). Ventral plate of gnathus bifid. Valve tapered apicad, apical fifth slightly spiral; dorsal margin minutely scobinate apicad, ventral margin smooth; a short arcuate ridge at mid-valve. Aedeagus tapered to narrowly rounded apex; a minute, thorn-like projection immediately below tip. Fulcrum extending beyond apex of aedeagus, the tip finely scobinate.

♀ genitalia (Pl. 45, figs 629, 630). Sterigma consisting of a strongly sclerotized plate shaped as in figure; a smaller plate, parallel in outline with the posterior margin of the sterigma, is situate immediately ventrad of the operculum.

Measurements. Fore wing: ♂♀ 13–17 mm. Antennal pectinations: ♂ 13 ×, ♀ 6 × diameter of shaft.

Most examples may be distinguished externally, except from *amelga*, by the deep, smooth-edged excavation of the non-hyaline terminal area on both wings and by the small area of dense, dark irroration on the fore wing between veins  $M_3$  and  $Cu_{1b}$ . Males may be distinguished from *amelga* by the shorter pectinations of the antennae; so far as is known, the distributions of the two species do not overlap. In the male genitalia the bifid ventral plate of the gnathus and the form of the slightly spiral valve and in the female the form of the sterigma are diagnostic.

DISTRIBUTION (Map 3). Rhodesia, Transvaal, Natal, Cape Province.

#### MATERIAL EXAMINED.

*Epione transvisaria* Guenée, holotype ♀, SOUTH AFRICA ('Pays des Namaquois'): 'Ex musaeo Ach. Guenée', Geometridae genitalia slide no. 5954, in BMNH. *Euchloris exarata* Felder, lectotype ♂, without abdomen, here designated, SOUTH AFRICA: Knysna (*Trimen*): 'Novara cxxvii f. 8 *Euchloris exarata* ♂ n. Cap.' [in Felder's hand-writing], in BMNH.

RHODESIA: Vumba Mts., Umtali, iv. 1955, 1 ♂; Vumba, 14.iv.1964 (*B. D. Barnes*), 1 ♀ (both NMR, Bulawayo). TRANSVAAL: Mariepskop, 15–24.iii.1965 (*Potgieter & v. Son*), 4 ♀; Mariepskop, Forestry, 7–9.ii.1963 (*L. Vári*), 1 ♂; Mariepskop, Pilgrims Rest Distr., 23–26.ii.1962 (*Vári & Leleup*), 1 ♀ (all TM, Pretoria). NATAL: Durban, Congella (*G. F. Leigh*), 1 ♂, 1 ♀ (BMNH); Durban (*Clark*), 1 ♀; Verulam, 28.i.1915 (*A. J. T. Janse*), 1 ♀; Karkloof, 13–19.xii.1930 (*A. J. T. Janse*), 1 ♀; Ingwavuma, 6–9.ii.1968 (*Potgieter & Jones*), 1 ♂ (all TM, Pretoria). CAPE PROVINCE: George, Saasveld, i–ii. 1965 (*H. Geertsema*), 2 ♂, 1 ♀; Knysna, 10–14.i.1955 (*A. J. T. Janse*), 1 ♂; Knysna, Garden of Eden, 16–20.i.1955

(*A. J. T. Janse*), 2 ♀ (all TM, Pretoria); Knysna Forest, Wilderness, 20.x-8.xi.1952 (*H. B. D. Kettlewell*), 3 ♂, 2 ♀; ibidem, ii, iv, 1 ♂, 1 ♀; Knysna (*R. Trimen*), 1 ♂ (*Comibaena reflexaria* Walker, paralectotype); E. Cape Prov., Katberg, 11-18.ii.1933 (*R. E. Turner*), 1 ♀; Transkei, Katberg (*H. B. D. Kettlewell*), 2 ♂ (all BMNH); Hogsback [32°26' S. 31°01' E.], 10-11.xii. 1956 (*van Son & Martin*), 4 ♂ (all TM, Pretoria).

### *Zamarada amelga* sp. n.

(Text-fig. 223; Map 3)

♂. Identical in colour and pattern with *transvisaria*. Males may be distinguished externally by the longer antennal pectinations.

♂ genitalia (Text-fig. 223). Distinguished from *transvisaria* by the form of the ventral plate of the gnathus, which has a rounded apex, and by the form of the valve, which is tapered to a narrow, truncate apex and has a longitudinal scobinate ridge which extends from one-fourth to apex.

♀ unknown.

Measurements. Fore wing: ♂ 14-15 mm. Antennal pectinations: ♂ 16 × diameter of shaft.

DISTRIBUTION. Tanzania.

Holotype ♂, TANZANIA ('Tanganyika'): Mufindi, 1954 (*P. Burdon*), Geometridae genitalia slide no. 7829, in BMNH.

Paratype. TANZANIA ('Tanganyika'): Iringa, Mufindi (*P. Burdon*), 1 ♂ (NMK, Nairobi).

### *Zamarada calypso* Prout

(Text-figs 224, 225; Pl. 45, figs 631, 632; Pl. 108, fig. 967; Map 3)

*Zamarada calypso* Prout, 1926 : 31. LECTOTYPE ♂, MADAGASCAR (BMNH), here designated [examined].

♂♀ (Pl. 108, fig. 967). Hyaline area of wings tinged with yellowish green and minutely striate with grey along posterior margins, the grey being vinaceous in oblique light, and finely edged distally with brown; discal spots minute and sharply marked, dark grey. Non-hyaline terminal area brownish orange (pl. 7, C4) varyingly irrorate with brownish grey (pl. 5, D2), densely in discal area; dentate subterminal fascia light brown (pl. 6, D6, cinnamon) irrorate with dark brown and finely edged distally with silvery buff, usually sharply defined; cilia chequered greyish buff and brownish grey. Underside of non-hyaline terminal area brownish grey, paler terminad.

♂ genitalia (Text-figs 224, 225). Uncus similar to those of *transvisaria* and *amelga*, but apical half longer and stouter and at base the lateral, setose projections are reduced. Ventral plate of gnathus broad and truncate. Valve tapered; apical third incurved towards uncus, ventral margin coarsely serrate. Aedeagus tapered to narrowly rounded apex. Fulcrum weakly scobinate apicad, coarsely scobinate at one-half.

♀ genitalia (Pl. 45, figs 631, 632). Sterigma asymmetrical; anterior margin irregularly serrate; operculum at left side; lamella postvaginalis with digitate process extending posteriorly at left side.



Measurements. Fore wing: ♂ 13.0–13.5 mm; ♀ 13.0–14.5 mm. Antennal pectinations: ♂ 10 ×, ♀ 8 × diameter of shaft.

Externally closely similar to *iobathra* Prout, with which it may occur in Kenya but may usually be distinguished by the sharply defined subterminal fascia and by the sharply marked, minute discal dots; in *iobathra* that on the fore wing is diffusely marked and usually none is present on the hind wing. Structurally the serrate apical third of the ventral margin of the valve in the male genitalia and the asymmetrical sterigma in the female genitalia are diagnostic.

DISTRIBUTION (Map 3). Madagascar, Kenya Coast, Ethiopia.

#### MATERIAL EXAMINED.

*Zamarada calypso* Prout, lectotype ♂ here designated, MADAGASCAR: Diego Suarez, 30.iv.1917 (G. Melou): '*Zamarada calypso* Prout ♂ type' [in Prout's handwriting]: Geometridae genitalia slide no. 5982, in BMNH.

MADAGASCAR: Diego Suarez, 14.iii–2.v.1917 (G. Melou), 2 ♂, 5 ♀; ibidem, 22.vi–25.viii.1917, 10 ♂, 3 ♀ (all paralectotypes of *Zamarada calypso* Prout, in BMNH); Nossi-Bé, 150 m, Forêt de Lokobe, 3–9.xi.1958 (P. Viette), 1 ♂, 1 ♀; massif de Tsaratanana (versant Ouest), 1850 m, vallée de l'Andavaka, 11–13.x.1966 (P. Soga), 2 ♂; Sakaraha, Zombitsy, 11–12.iv.1956 (P. Griveaud), 1 ♂ (all MNHN, Paris); La Mandraka Forest, 70 km E. of Tananarive, ix. 1962 (R. Vieu), 1 ♀ (NMR, Bulawayo). KENYA: Nyali, xi–xii (D. G. Sevastopulo), 1 ♂, 1 ♀; Kenya Coast, Shimba Hills, xii. 1961 (R. Carcasson), 1 ♂, 1 ♀ (all BMNH). ETHIOPIA: Dire Daoua, iv–v. 1936 (H. Uhlenhuth), 2 ♀ (BMNH).

#### *Zamarada iobathra* Prout

(Text-figs 226, 227; Pl. 46, figs 633, 634; Pl. 108, fig. 973; Map 3)

*Zamarada iobathra* Prout, 1932 : 507. Holotype ♀, KENYA (MNHN) [examined].

♂ genitalia (Text-figs 226, 227). Uncus short, stout and tapered with two pairs of lateral processes. Valve simple; dorsal margin sclerotized, apical third serrate. Apical half of aedeagus narrowed to thorn-like tip. Fulcrum weakly developed, not extending to apex of aedeagus. Vesica with a short, scobinate cornutus.

♀ genitalia (Pl. 46, figs 633, 634). Posterior margin of sterigma arcuate and minutely serrate. Posterior third of corpus bursae sclerotized as illustrated; remainder membranous.

Measurements. Fore wing: ♂ ♀ 13–15 mm. Antennal pectinations: ♂ 10 ×, ♀ 6 × diameter of shaft.

Externally closely similar to *calypso*; most examples may be distinguished by the less well defined, paler, brownish orange subterminal fascia and the more diffuse discal spot on the fore wing (Pl. 108, fig. 973); in most examples the discal spot on the hind wing is absent. Externally similar also to *bathyscaphes* and to *adiposata* in the *bathyscaphes*-group, but the distribution of *iobathra* is not known to overlap that of either of the two other species. Structurally the form of the valve and of the fulcrum and aedeagus in the male genitalia and the form of the sterigma in the female genitalia are diagnostic for *iobathra* and for *polyctemon*,

which have identical genitalia; these two species are distinguished by colour and wing-pattern.

DISTRIBUTION (Map 3). Kenya, Tanzania.

#### MATERIAL EXAMINED.

*Zamarada iobathra* Prout, holotype ♀, without abdomen, KENYA: Pori, Mbuyuni, 1110 m, iii. 1912 (*Alluaud & Jeannel*), in MNHN, Paris.

KENYA: N. F. D., Marsabit, 4500 ft, ii. 1956 (*J. G. Williams*), 1 ♂ (NMK, Nairobi), 1 ♂, 1 ♀ (BMNH); Isiolo, N.E. Mt Kenya, 800 m, iii. 1969, 1 ♂, 1 ♀; Isiolo, 2-15.iii.1969, 1 ♂, 2 ♀; Musthomo, 13.iii.1969, 2 ♂; Mutha, 5-12.iv.1969, 1 ♀ (all *Watulege*, in coll. Herbulot, Paris); Fort Hall, 1957 (*Saunders*), 1 ♂, 2 ♀; Ngong, Nairobi, ii, iv, v, x, xi (*Fowler & Coulson*), 2 ♂, 3 ♀ (all NMK, Nairobi); Nairobi, 2 ♂, 6 ♀ (NMK, Nairobi), 5 ♀ (BMNH); Nairobi Plains, Kikuyu, 5400 ft, 28.iv.1900 (*R. Crawshay*), 1 ♂ (*Zamarada iobathra* Prout, paratype) (BMNH); Kinangop, iv. 1926 (*van Someren*), 1 ♀ (BMNH); Mtito Andei, iv. 1966 (*R. H. Carcasson*), 1 ♀ (NMK, Nairobi); Kibwezi, iii-v, xi (*W. Feather*), 2 ♂, 4 ♀ (*Zamarada iobathra* Prout, paratypes) (BMNH). TANZANIA: Mt Meru, Momella, 1600-1800 m, i-ii. 1964 (*W. Forster*), 4 ♀ (ZSBS, Munich).

#### *Zamarada euryscaphes* Prout

(Pl. 46, figs 635, 636; Pl. 108, fig. 971; Map 3)

*Zamarada euryscaphes* Prout, 1915 : 345. Holotype ♀, ETHIOPIA (BMNH) [examined].

♀ (Pl. 108, fig. 971). Closely similar to *iobathra* in colour and structure; distinguished by the extension of the hyaline area to the termen between veins  $M_3$  and  $Cu_{1b}$  on each wing and by the presence of a well developed discal spot on the hind wing.

♀ genitalia (Pl. 46, figs 635, 636).

♂ unknown.

Measurements. Fore wing: ♀ 15 mm. Antennal pectinations: ♀ 8 × diameter of shaft.

When the male of *euryscaphes* is known, the relationship with *iobathra* may prove to be subspecific.

DISTRIBUTION (Map 3). Ethiopia.

#### MATERIAL EXAMINED.

*Zamarada euryscaphes* Prout, holotype ♀, ETHIOPIA ('Eritrea'): Asmara, 20.x.1905 (*N. Beccari*), Geometridae genitalia slide no. 3302, in BMNH.

#### *Zamarada polycitemon* Prout

(Pl. 108, fig. 970; Map 3)

*Zamarada polycitemon* Prout, 1932a : 248. Holotype ♀, ZAIRE (BMNH) [examined].

♂ ♀ (Pl. 108, fig. 970). Hyaline area of wings wax-yellow (pl. 3, B5) striate with brownish grey (pl. 8, D2), densely at mid-posterior margin of each wing, sparsely elsewhere; hyaline

area extending to termen between veins  $M_3$  and  $Cu_{1b}$ ; small basal area on each wing, large discal spot on fore wing and small discal dot on hind wing brownish grey. Non-hyaline terminal area brownish grey narrowly edged proximally with brownish orange and irrorate with dark grey to black; ill-defined subterminal fascia dentate, dark grey to black; terminal interneural spots between veins  $M_3$ - $Cu_{1b}$ , when present, similarly coloured. Underside of non-hyaline apical area of fore wing uniformly dark brown; tornal area of fore wing and anal area of hind wing dark brown edged posteriorly with light brown; apical area of hind wing dark brown edged anteriorly with light brown.

Measurements. Fore wing: ♂ 12.0-14.5 mm; ♀ 13.0-14.5 mm. Antennal pectinations: ♂ 10 ×, ♀ 7 × diameter of shaft.

Two examples from Nigeria differ in having the terminal area formed as in *polycytemon*, but densely suffused with brownish yellow; the hyaline area is pale and the discal spots small, as in *iobathra*. Further material may show the Nigerian populations, *polycytemon* and *iobathra* to be subspecies of *euryscaphes*.

Identical in structure with *iobathra* and *euryscaphes*, but strikingly distinct in both colour and pattern.

DISTRIBUTION (Map 3). Tanzania, Zambia, Rhodesia, Zaire, Angola, Nigeria, Cameroun.

#### MATERIAL EXAMINED.

*Zamarada polycytemon* Prout, holotype ♀, ZAIRE ('Belgian Congo'): Kafakumba, 1929 (G. F. Overlaert), without abdomen, in MRAC, Tervuren.

TANZANIA: Amani (Pringle), 3 ♂, 1 ♀; ibidem, xi. 1962, 1 ♂ (all BMNH); Amani, xi. 1965 (R. H. Carcasson), 2 ♂ (NMK, Nairobi). ZAMBIA: Mwinilunga, 12.i.1965, 1 ♂; ibidem, 9.v.1963, 1 ♀ (both BMNH); ibidem, v. 1961, 1 ♂ (NMR, Bulawayo). RHODESIA: Matopos, Mtshabezi Valley, iii. 1966, 1 ♀; Vumba Mts., Umtali, ii-iii.1961, 1 ♂ (BMNH); ibidem, i-ii. 1960, 1 ♂; ii-iii. 1962, 1 ♂ (both NMR, Bulawayo). ZAIRE ('Belgian Congo'): Elisabethville, 17.iii.1952 (C. Seydel), 1 ♂; ibidem, 9.vi.1952, 1 ♂; Shinkolobwe, 18.vii.1931, 1 ♂. ANGOLA: Malange, 25.ii.1909 (W. J. Ansorge), 1 ♂ (*Zamarada polycytemon* Prout, paratype); Gamba, Bihé, xii. 1934 (R. Braun), 1 ♂. NIGERIA: Jos, vi. 1960 (J. Boorman), 2 ♂ (all BMNH). CAMEROUN: Plateau de Kounden, 4 km S.E. Centre Vétérin, 1410 m, 6-7.iv.1972 (C. Herbulot), 2 ♂ (coll. Herbulot, Paris).

#### THE BATHYSCAPHES-GROUP

Characterized in the male genitalia by the form of the uncus, the apical third or half slender and tapered, the base bulbous; by the weakly developed arms of the gnathus and by the absence of a ventral plate; by the form of the dorsal process of the valve, which is angled through 90 degrees at one-half, the apical half bearing long, coarse spines; by the form of the fulcrum, which is dilate and bilobate apicad to partly enfold the tip of the aedeagus and by the form of the vesica, which bears a cluster of short spines. The male hind tibia is simple.

In the female genitalia the lamella antevaginalis is sclerotized in the form of

a transverse band, broadened laterally and often ornamented with spine-like projections, symmetrical or asymmetrical.

Distributed south of about 9° S. latitude.

KEY TO SPECIES

- 1 Distal margin of hyaline area of wings evenly crenulate or dentate, not bowed distad between veins  $M_3$  and  $Cu_{1b}$ . Non-hyaline terminal area of fore wing not wider than 1.5 mm at and posterior of vein  $M_3$ . Apical half of uncus laterally compressed; dorsal-ventral depth equals one-half of greatest width of aedeagus . . . . . *angustimargo* (p. 142)
- Distal margin of hyaline area of wings bowed distad between veins  $M_3$  and  $Cu_{1b}$ . Non-hyaline terminal area of fore wing more than 2 mm wide at and posterior of vein  $M_3$ . Uncus not so formed . . . . . 2
- 2 (1) Margins of both valves smooth; left valve with broad-based, tapered process in middle of apical third . . . . . *psi* (p. 142)
- Apical margin of each valve with one or more short, thorn-like projections . . . . . 3
- 3 (2) Apical margin of each valve with one thorn-like projection . . . . . 4
- Left valve with two thorn-like or angular projections from, or from near, apex . . . . . 5
- 4 (3) Apical projections symmetrical; dorsal process with short, setose, digitate projection at one-third . . . . . *aequilumata* (p. 140)
- Apical projections asymmetrical; base of projection on right valve extended basad along middle of valve in form of slender, sclerotized ridge; dorsal process setose in basal third, but no digitate projection developed . . . . . *bathyscaphes* (p. 137)
- 5 (3) Apex of dorsal margin of each valve rounded. Left valve with angular projection in apical fourth, near dorsal margin . . . . . *odontophora* (p. 139)
- Apex of dorsal margin of each valve produced in thorn-like form . . . . . 6
- 6 (5) Left valve with a sclerotized ridge just below thorn-like extension of dorsal margin . . . . . *adiposata* (p. 139)
- Left valve without sclerotized ridge below thorn-like extension of dorsal margin . . . . . *aclea* (p. 141)

*Zamarada bathyscaphes* Prout

(Text-figs 228, 229; Pl. 47, fig. 639; Pl. 48, figs 642, 643; Pl. 109, fig. 974)

*Zamarada bathyscaphes* Prout, 1912 : 196. Holotype ♀, RHODESIA (BMNH) [examined].

*Zamarada perplexa* Janse, 1932 : 139, pl. 2, fig. 24, text-fig. 38. Holotype ♂, RHODESIA (TM, Pretoria) [examined]. **Syn. n.**

*Zamarada bathyscaphes* Prout; Janse, 1932 : 143, pl. 10, fig. 2. [Photograph of damaged genitalia.]

♂ ♀ (Pl. 109, fig. 974). Hyaline area of wings, extending to termen along vein  $Cu_{1a}$ , greyish yellow, slenderly edged distally with black; discal spots grey. Small area at base and non-hyaline terminal area of each wing variable in colour, ranging from brownish orange (pl. 6, C6, caramel-brown) to light brown (pl. 6, D4, camel); dentate subterminal fascia weakly marked in a shade darker than the ground colour and slenderly edged distally with light yellow; cilia chequered light brown and light yellow. Underside of non-hyaline terminal area varying in colour, being comparable with that of the upperside.

♂ genitalia (Text-figs 228, 229). Valves asymmetrical; apical margin of each valve with



a thorn-like projection; base of projection on right valve extended basad along middle of valve in form of slender, sclerotized ridge; dorsal process setose in basal third, but without projection.

♀ genitalia (Pl. 47, fig. 639; Pl. 48, figs 642, 643). Lamella antevaginalis sclerotized as illustrated; lateral margins variable, rounded in holotype (Pl. 48, fig. 642), tapered in other examples (Pl. 48, fig. 643); a topotypical paratype is intermediate in form between the two examples illustrated. Posterior fourth of corpus bursae weakly ribbed and minutely scobinate.

Measurements. Fore wing: ♂ ♀ 12.5–14.0 mm. Antennal pectinations: ♂ 8 ×, ♀ 2 × diameter of shaft.

Most examples may be distinguished externally from related species in the *bathyscaphes*-group by the more dentate penetration of hyaline into the non-hyaline terminal area of each wing and especially by the tapered extension to the termen along vein  $Cu_{1a}$ . The female may be distinguished from closely related *adiposata* by the shorter antennal pectinations, those of *bathyscaphes* being twice as long as the diameter of the shaft, those of *adiposata* being six times as long as the diameter of the shaft.

Externally similar also to *iobathra* and *calypso* in the *iobathra*-group, but the distribution of *bathyscaphes* does not appear to overlap that of either of those two species.

In the male genitalia the form of the asymmetrical valves and in the female genitalia the form of the sterigma are diagnostic.

DISTRIBUTION. Tanzania, Burundi, Zaire, Zambia, Malawi, Mozambique, Rhodesia.

#### MATERIAL EXAMINED.

*Zamarada bathyscaphes* Prout, holotype ♀, RHODESIA: Selukwe, x. 1911 (*F. W. Short*), Geometridae genitalia slide no. 6007, in BMNH. *Zamarada perplexa* Janse, holotype ♂, RHODESIA: Umvuma, 10.i.1918 (*Carnegie*), ex coll. A. J. T. Janse, genitalia slide no. G2710, type no. 2224, in TM, Pretoria.

TANZANIA: Dodoma, iii. 1950 (*N. Mitton*), 1 ♂; Morogoro, Ilonga i–iii. 1965 (*Mrs Chalmers*), 1 ♂ (both NMK, Nairobi). BURUNDI: Upper Ruvuvu River, vii–viii. 1919 (*T. A. Barns*), 1 ♀ (BMNH). ZAIRE ('Belgian Congo'): Elisabethville, i, viii, ix, xii (*C. Seydel*), 3 ♂, 3 ♀ (all MRAC, Tervuren); Ht. Katanga, Sakania, 30.i.1932 (*J. Romieux*), 1 ♂ (MHN, Geneva). ZAMBIA: Abercorn, i. 1964, 1 ♀ (NMR, Bulawayo); Broken Hill, 24.ii.1950 (*N. Mitton*), 1 ♀ (TM, Pretoria); Lusaka, i, v (*R. C. Dening*), 1 ♂, 1 ♀ (BMNH); ibidem, 18.ii.1962, 1 ♂ (NMR, Bulawayo). MALAWI: Karonga, 1 ♀ (CM, Pittsburgh); Kasangazi, near Bandawe, 3000 ft above L. Nyasa (*Dr Prentice*), 1 ♂; Zomba (*H. N. Stannus*), 1 ♂; Blantyre, 18.v.1910 (*J. E. S. Old*), 1 ♂; Mt Mlanje, 28.ii.1913 (*S. A. Neave*), 1 ♀; ibidem, 15.iv.1913, 1 ♂ (all BMNH). MOZAMBIQUE: Ruo Valley, 1.iv.1913 (*S. A. Neave*), 1 ♂ (BMNH); Zambezia Prov., 16 miles N.E. of Molumbo, 30.iv.1970 (*E. Pinhey*), 1 ♂; 16 miles S. of Vila Junqueiro, 1.v.1970 (*E. Pinhey*), 1 ♂ (both NMR, Bulawayo). RHODESIA: Salisbury, 1 ♀ (ZSBS, Munich); ibidem, ii, v, 2 ♂ (NMR, Bulawayo); Marandellas, i, x, xii, 3 ♂, 1 ♀ (NMR, Bulawayo); Selukwe, i–iii, viii, x, xii (*F. W. Short*), 7 ♂, 3 ♀; Umtali, viii. 1966 (*A. Richardson*), 1 ♂ (all BMNH); Turk Mine, ix. 1960, 2 ♂; Khami, xii. 1960, 1 ♀ (all NMR, Bulawayo); Fort Victoria, 30.viii.1966, 1 ♂; Lundi, 2–16.iii.1964 (*Vári & van Son*), 9 ♂, 2 ♀ (all TM, Pretoria).

*Zamarada adiposata* (Felder)

(Text-figs 230, 231; Pl. 47, fig. 640; Pl. 48, figs 644, 645; Pl. 109, fig. 975)

*Euchloris adiposata* Felder, 1875 : 9, pl. 127, figs 19, 19a. Holotype ♂, SOUTH AFRICA (BMNH) [examined].*Zamarada adiposata* (Felder) Oberthür, 1912 : 257.*Zamarada adiposata* (Felder); Janse, 1932 : 140, pl. 2, fig. 3a, text-fig. 39a.

♂ genitalia (Text-figs 230, 231). Valves asymmetrical, the tapered dorsal and ventral apices of the left valve longer than those of the right; left valve with a sclerotized ridge just below tapered dorsal apex.

♀ genitalia (Pl. 47, fig. 640; Pl. 48, figs 644, 645). Lamella antevaginalis asymmetrical, the lateral spine-like projections varying individually.

Measurements. Fore wing: ♂ ♀ 12–15 mm. Antennal pectinations: ♂ 9 ×, ♀ 6 × diameter of shaft.

Externally closely similar to *bathyscaphes*, differing in the less extensive distal penetration of the hyaline area of each wing, which only rarely extends to the termen along vein  $Cu_{1a}$ , and in the more heavily marked, dentate subterminal fascia (Pl. 109, fig. 975). The female may be distinguished by the longer antennal pectinations, which are six times instead of twice as long as the diameter of the shaft.

In the male genitalia the form of the asymmetrical valves and in the female genitalia the form of the sterigma are diagnostic.

DISTRIBUTION. Mozambique, Transvaal, Natal, Cape Province.

## MATERIAL EXAMINED.

*Euchloris adiposata* Felder, holotype ♂, SOUTH AFRICA ('Caffraria'): Tsome R. (J. H. Bowker), Geometridae genitalia slide no. 1592, in BMNH.

MOZAMBIQUE: Limpopo R., 17 miles S. of Chitrapadzi, 5.v.1968 (E. Pinhey), 1 ♂ (NMR, Bulawayo). TRANSVAAL: Wylies Poort, 5 miles N., 21–22.iii.1954 (A. J. T. Janse), 1 ♂; Limburg, Potgietersrus Distr., 9–10.xii.1964 (Vári &amp; Potgieter), 2 ♂, 1 ♀; ibidem, 12–14.iv.1968 (L. Vári), 1 ♂; ibidem, 12.xii.1963, 1 ♀; Kruger National Park, Punda Milia, 1–5.xii.1964 (Vári &amp; Potgieter), 1 ♂; Nwanedzi, 20–30.iv.1969 (Potgieter &amp; Strydom), 1 ♀; Skukuza, 10.ii.1963 (L. Vári), 1 ♀; ibidem, 26–28.iv.1968 (Potgieter &amp; Goode), 2 ♂, 1 ♀; Matjulwana, 5.xii.1963 (L. Vári), 2 ♀; Malelane, 3–5.xii.1963 (L. Vári), 1 ♀ (all TM, Pretoria). NATAL: Ndumu, 10–12.ii.1968 (Potgieter &amp; Jones), 1 ♂, 3 ♀; Mkuzi Game Reserve, 8.xii.1960 (G. van Son), 1 ♀; Jozini Dam, Lebombo Mts, 9–14.i.1965 (L. Vári), 10 ♂, 1 ♀; Muden, 3–6.xii.1954 (H. Cookson), 1 ♂ (all TM, Pretoria).

*Zamarada odontophora* sp. n.

(Text-figs 232, 233; Pl. 47, figs 637, 638; Pl. 109, fig. 977)

♂ ♀ (Pl. 109, fig. 977). Basal area and non-hyaline terminal area of each wing greyish orange (pl. 6, 5B), proximal margin of the latter slenderly but distinctly suffused with grey; penetration

by hyaline area as in *adiposata*; dentate subterminal fascia weakly marked as in *bathyscaphes*; discal spots sometimes wanting. Underside of non-hyaline terminal area greyish orange, as on upperside, the grey proximal suffusion more strongly marked.

♂ genitalia (Text-figs 232, 233). Valves asymmetrical; apex of each ventral margin produced and tapered, apex of each dorsal margin rounded; left valve with angular projection in apical fourth near dorsal margin.

♀ genitalia (Pl. 47, figs 637, 638). Lamella antevaginalis similar in form to that of *bathyscaphes*, but ornamented with spine-like projections; lamella postvaginalis with a pair of strongly sclerotized lateral ridges.

Measurements. Fore wing: ♂ 13 mm; ♀ 13–16 mm. Antennal pectinations: ♂ 8 ×, ♀ 3 × diameter of shaft.

Intermediate in pattern between *bathyscaphes* and *adiposata*, having the weakly marked subterminal fascia of the former and the less extensive hyaline area of the latter. Female antennae with short pectinations, as in *bathyscaphes*. In the male genitalia the form of the asymmetrical valves and in the female the form of the sterigma, especially the laterally ridged lamella postvaginalis, are diagnostic.

DISTRIBUTION. Rhodesia.

Holotype ♂, RHODESIA: Msali Bridge, 17–19.iv.1954 (A. J. T. Janse), in TM, Pretoria.

Paratypes. RHODESIA: holotype data, 2 ♀ (TM, Pretoria), 1 ♀ (BMNH).

### *Zamarada aequilumata* sp. n.

(Text-figs 234, 235; Pl. 47, fig. 641; Pl. 49, figs 646, 647; Pl. 109, fig. 976)

♂♀ (Pl. 109, fig. 976). Basal area of fore wing and non-hyaline terminal area of each wing greyish orange (pl. 5, B5–pl.6, B4), the latter suffused proximally with grey; non-hyaline terminal area less broad than in the preceding species and with less deep intrusions of hyaline between veins  $M_3$  and  $Cu_{1b}$ ; ill-defined subterminal fascia dentate, brownish orange; discal spots sometimes wanting. Underside of non-hyaline terminal area of wings light orange (pl. 5, A4) to brownish orange suffused with dark grey proximally, anterior of vein  $M_3$  on each wing and posterior of vein  $Cu_{1b}$  on fore wing.

♂ genitalia (Text-figs 234, 235). Valves symmetrical and ovate, each with a strongly sclerotized, thorn-like apical projection; dorsal process with a setose, digitate projection at one-third.

♀ genitalia (Pl. 47, fig. 641; Pl. 49, figs 646, 647). Sterigma symmetrical, as illustrated; lamella antevaginalis with a pair of lateral, broad-based, thorn-like projections posteriorly inclined.

Measurements. Fore wing: ♂ 12–15 mm; ♀ 13 mm. Antennal pectinations: ♂ 9 ×, ♀ 2 × diameter of shaft.

Distinguished externally from the preceding species in the group by the paler coloured and narrower, non-hyaline terminal area of each wing and by the shallower hyaline intrusions between veins  $M_3$  and  $Cu_{1b}$ . In the male genitalia the symmetrical valves and in the female the symmetrical projections from the lamella antevaginalis are diagnostic.

DISTRIBUTION. Tanzania, Zaire, Zambia, Malawi.

Holotype ♂, ZAMBIA: Abercorn, iii. 1966 (*I.R.L.C.S.*), Geometridae genitalia slide no. 7166, in BMNH.

Paratypes. TANZANIA: Morogoro, Ilonga, i-iii. 1965 (*Mrs Chalmers*), 1 ♂ (NMK, Nairobi). ZAIRE ('Belgian Congo'): Ht Katanga, Shinkolobwe (Tshinkolobwe), 25.vii.1930 (*J. Romieux*), 1 ♂ (MHN, Geneva); Shinkolobwe, 30.vii.1930, 1 ♂ (BMNH); Elisabethville, 24.x.1948 (*C. Seydel*), 1 ♂; ibidem, 28.x.1948, 1 ♀; 3.xi.1948, 1 ♀; 4.xi.1948, 1 ♂; 16.xi.1950, 1 ♀ (all MRAC, Tervuren); ibidem, 25.xi.1954, 1 ♂ (BMNH); Katanga, Kipopo, x-xii. 1961 (*Don R. Maréchal*), 1 ♀ (MRAC, Tervuren). ZAMBIA: Abercorn, i. 1966 (*I.R.L.C.S.*), 1 ♂; ibidem, xi. 1963, 1 ♂; ibidem, 3-4.i.1964, 1 ♂; Ndola, xii. 1960, 1 ♀; Zambezi Rapids, Mwinilunga, 10.v.1963, 1 ♂ (all NMR, Bulawayo). MALAWI: Nkata Bay, Mkuwadzi Forest, 10.v.1966, 1 ♀ (BMNH).

### *Zamarada aclea* Prout

(Text-figs 236, 237; Pl. 49, figs 648, 649; Pl. 109, fig. 979)

*Zamarada aclea* Prout, 1912 : 200. Holotype ♀, RHODESIA (BMNH) [examined].

*Zamarada aclea* Prout; Janse, 1932 : 143, pl. 10, fig. 1. [Broken genitalia.]

♂ ♀ (Pl. 109, fig. 979). Hyaline area of wings greenish white; discal spots wanting. Non-hyaline terminal area of each wing very slender and only shallowly excavate between veins  $M_3$  and  $Cu_{1b}$ ; variable in colour, from greyish orange (pl. 5, B5) to brownish orange (pl. 5, C5) suffused proximally with grey; dentate subterminal fascia orange brown slenderly edged distally with light yellow, marked on anterior half of fore wing only. Underside of non-hyaline terminal area similar to upperside, but grey suffusion more strongly marked.

♂ genitalia (Text-figs 236, 237). Valves asymmetrical. Left valve with short, thorn-like projection from mid-apical margin; apex of dorsal margin produced in short, thorn-like form. Right valve: apex of dorsal margin similar to that of left valve; mid-apical margin with minute, thorn-like projection.

♀ genitalia (Pl. 49, figs 648, 649). Closely similar to *aequilumata*, differing in the more slender spined projections from the lamella antevaginalis.

Measurements. Fore wing: ♂ 12-16 mm; ♀ 14 mm. Antennal pectinations: ♂ 9 ×, ♀ 2 × diameter of shaft.

Distinguished externally by the appreciably narrower non-hyaline terminal area of each wing and by the absence of discal spots. In the male genitalia the form of the asymmetrical valves and in the female genitalia the slender, lateral projections from the lamella antevaginalis are diagnostic.

DISTRIBUTION. Rhodesia.

### MATERIAL EXAMINED.

*Zamarada aclea* Prout, holotype ♀, RHODESIA: Selukwe, xi. 1911 (*F. W. Short*), Geometridae genitalia slide no. 5946, in BMNH.

RHODESIA: Selukwe, ii, iv, v, vii, viii (*F. W. Short*), 9 ♂, 1 ♀; ibidem, xii. 1911, 1 ♀ (*Zamarada aclea* Prout, paratype) (all BMNH); Umtali, Vumba Mts, ii-iii. 1961, 1 ♂ (NMR, Bulawayo); Penhalonga (*O. A. Kidwell*), 1 ♂ (BMNH); Gwaai, 16.i.1927, 1 ♀ (TM, Pretoria).



*Zamarada angustimargo* Warren

(Text-figs 238, 239; Pl. 109, fig. 978)

*Zamarada angustimargo* Warren, 1901 : 212. Holotype ♂, ANGOLA (BMNH) [examined].

♂ (Pl. 109, fig. 978). Distal margin of greenish white hyaline area of each wing evenly crenulate or dentate, finely edged with black. Narrow non-hyaline terminal area light buff edged proximally with grey; area not wider than 1.5 mm at and posterior of vein  $M_3$  on fore wing.

♂ genitalia (Text-figs 238, 239). Apical half of uncus laterally compressed, dorso-ventral depth equals one-half greatest width of aedeagus. Valves symmetrical, each with a stout, apical spine and a small fold on dorsal margin; dorsal process with a small setose projection at one-fourth.

♀ unknown.

Measurements. Fore wing: ♂ 12 mm. Antennal pectinations: ♂ 10 × diameter of shaft.

Distinguished externally from other species in the *bathyscaphes*-group by the slender, even, non-hyaline terminal area of each wing. Structurally closely similar to *aequilumata*, from which it differs in the male genitalia in the stouter uncus, in the form of the valve and its dorsal process and especially in the presence of a small fold on the dorsal margin of each valve.

DISTRIBUTION. Angola.

## MATERIAL EXAMINED.

*Zamarada angustimargo* Warren, holotype ♂, ANGOLA: Luacinga R., xi. 1899 (*Penrice*), Geometridae genitalia slide no. 5945, in BMNH.

*Zamarada psi* sp. n.

(Text-figs 240, 241; Pl. 50, figs 650, 651; Pl. 109, fig. 981)

[*Zamarada pyrocincta* Hampson, 1910 : 470 (part). Misidentification.]

♂♀ (Pl. 109, fig. 981). Hyaline area of wings greyish white very lightly irrorate with grey; discal spots minute. Non-hyaline terminal area of each wing light brown, shaded with grey proximad of the weakly marked, dentate subterminal fascia. Underside of non-hyaline terminal area light brown shaded proximally with dark grey on fore wing and between costa and vein  $M_3$  on hind wing.

♂ genitalia (Text-figs 240, 241). Valves asymmetrical; right valve broadly rounded at apex, left valve rather more slender, but with a broad-based, tapered process in middle of apical third; dorsal process with a setose dilation at one-fourth. Aedeagus with a small, thorn-like projection just below narrowly rounded apex.

♀ genitalia (Pl. 50, figs 650, 651). Closely similar to *adiposata*, with strongly developed, spine-like projections at each side of operculum; medial area of membranous lamella postvaginalis with concentric, membranous ridges forming a raised lobe.

Measurements. Fore wing: ♂ 11.5 mm; ♀ 11-12 mm. Antennal pectinations: ♂ 10 ×, ♀ 4 × diameter of shaft.

A species that is most readily recognisable by the form of the strikingly asymmetrical valves in the male genitalia and by the form of the sterigma in the female genitalia.

DISTRIBUTION. Zambia.

Holotype ♂, ZAMBIA ('N. Rhodesia'): Upp. Luangwa, Luwumbu Valley, 2500–3500 ft, 21.vii.1910 (S. A. Neave), Geometridae genitalia slide no. 5936, in BMNH.

Paratypes. ZAMBIA ('N. Rhodesia'): Abercorn, iv. 1964 (D. Vesey-Fitzgerald), 1 ♂ (BMNH); Lower Chumbezi Valley, Mpika distr., 17.v.1908 (S. A. Neave), *Zamarada pyrocincta* Hampson, paratype ♀ [misidentification] (UM, Oxford); Bwana Mkubwa, ix. 1929 (Bell-Marley), 1 ♂ (BMNH).

#### THE *PURIMARGO*-GROUP

Related to, but distinguished from the *bathyscaphes*-group by the male genitalia, which are characterised by the short, almost straight dorsal process of the valve, the process being densely and finely spined in its apical half; by the truncate, asymmetrical valves and by the form of the fulcrum, which is dilate and spiral apicad with one surface densely coarsely scobinate. The male hind tibia is simple.

In the female genitalia the sterigma is asymmetrical with finely tapered, sometimes serrate-edged projections extending posteriorly from the lamella antevaginalis.

#### *Zamarada purimargo* Prout

(Text-figs 242, 243; Pl. 50, figs 652, 653; Pl. 109, figs 980, 982)

*Zamarada purimargo* Prout, 1912 : 197. Holotype ♀, RHODESIA (BMNH) [examined].

*Zamarada purimargo* Prout; Janse, 1932 : 143.

*Zamarada viridiceps* Prout, 1934a : 95. Holotype ♀, ZAIRE (MRAC, Tervuren) [examined].

#### Syn. n.

♂ ♀ (Pl. 109, figs 980, 982). Hyaline area of wings greenish white; discal spots minute or absent. Basal area of fore wing greyish orange to light brown. Non-hyaline terminal area of each wing greyish orange (pl. 6, B3) to light brown (pl. 6, D8), uniformly coloured in the female, varyingly suffused with greyish brown (pl. 6, F3, negro) in the male, the suffusion often irregularly concentrated immediately distad of the hyaline area; subterminal fascia not marked. Underside of non-hyaline terminal area similar to upperside.

♂ genitalia (Text-figs 242, 243). Apical half of uncus slender and tapered; basal half triangular. Arms of gnathus weakly sclerotized and tapered; ventral plate not developed. Valves asymmetrical, as illustrated; dorsal process almost straight, apical half densely and finely spined to rounded apex. Aedeagus tapered apicad, scobinate on dorsal surface at three-fourths. Fulcrum longer than aedeagus, dilate and spiral in apical half, apical surface coarsely and densely spined. Vesica without cornutus.

♀ genitalia (Pl. 50, figs 652, 653). Sterigma asymmetrical with finely tapered projections, sometimes serrate-edged, extending posteriorly from lamella antevaginalis.

Measurements. Fore wing: ♂ ♀ 13–15 mm. Antennal pectinations; ♂ 8 ×, ♀ 2 × diameter of shaft.

A species readily distinguishable by colour and pattern. In the male genitalia the form of the valve, with the straight, finely spined dorsal process, and in the female genitalia the form of the lamella antevaginalis are diagnostic.

DISTRIBUTION. Tanzania, Zaire, Zambia, Malawi, Mozambique, Rhodesia, Angola.

#### MATERIAL EXAMINED.

*Zamarada purimargo* Prout, holotype ♀, RHODESIA: Selukwe, 20-27.x.1911 (*F. W. Short*), Geometridae genitalia slide no. 1688, BMNH. *Zamarada viridiceps* Prout, holotype ♀, ZAIRE ('Belgian Congo'): Elisabethville, i. 1930 (*C. Seydel*), in MRAC, Tervuren.

TANZANIA: Morogoro, Ilonga, i-iii. 1965 (*Mrs Chalmers*), 1 ♂. ZAIRE ('Belgian Congo'): Ht Katanga, Vallée de la Luina, 11.iii.1930 (*J. Romieux*), 1 ♂ (MHN, Geneva); Elisabethville, x, xi (*C. Seydel*), 2 ♀ (BMNH), 1 ♂ (MRAC, Tervuren); Kolwezi, ix. 1964 (*V. Allard*), 1 ♀ (NMK, Nairobi). ZAMBIA: Mwinilunga, Zambezi Rapids, 19.i.1965, 1 ♂; ibidem, v. 1963, 2 ♂ (all NMR, Bulawayo); Nkana, xii. 1933 (*Mrs Prismall*), 1 ♂ (TM, Pretoria); Bwana Mkubwa, xi. 1929, 1 ♀ (BMNH); Abercorn, ii. 1964 (*D. Vesey-Fitzgerald*), 1 ♂ (NMK, Bulawayo). MALAWI: Cent. Angoniland, Lilongwe Distr., 4-5000 ft, 2.vi.1910 (*S. A. Neave*), 1 ♀; Zomba, i. 1925 (*H. Barlow*), 1 ♀ (both BMNH); Limbe, Bvumbwe Exp. Stn., 11.viii.1968, 1 ♂ (NMR, Bulawayo). MOZAMBIQUE: Zambezia Prov., 16 miles S. of Vila Junqueiro, 1.v.1970 (*E. Pinhey*), 1 ♂ (NMR, Bulawayo). RHODESIA: Shamva, xii. 1921 (*O'Neil*), 1 ♀ (BMNH); Vumba, viii (*B. D. Barnes*), 2 ♂; Vumba Mts, Umtali, ii-iii. 1962, 1 ♂; Gatooma, iii. 1956, 1 ♂ (all NMR, Bulawayo); Melsetter, Mountain Inn, xi. 1950 (*H. B. D. Kettlewell*), 1 ♀ (BMNH). ANGOLA: Bihé, Gamba, xii. 1934 (*R. Braun*), 1 ♀ (BMNH).

#### THE *DILUCIDA*-GROUP

Placed near the *excavata*-group because of habitus and the form of the broad-based, tapered uncus, simple valve and simple juxta in the male genitalia. Distinguished by the presence of two lobate processes on the aedeagus and the strikingly distinctive cornutus on the vesica, arcuate in shape with a barbed tip. In the male the hind tibia is dilate with a hair-pencil. In both sexes the discal spots are absent from both fore and hind wings.

In the female genitalia the simple, V-shaped operculum is covered ventrally by a crenulate, membranous pocket.

#### *Zamarada dilucida* Warren

(Text-figs 244, 245; Pl. 52, figs 658, 659; Pl. 110, figs 984, 985)

*Zamarada dilucida* Warren, 1909 : 114. Holotype ♂, NIGERIA (BMNH) [examined].

(Pl. 110, figs 984, 985). Hyaline area of wings finely but sparsely striate with light grey; discal spots absent. Non-hyaline terminal area of each wing purplish grey proximad of sharply marked brownish orange, subterminal fascia and greyish orange distad of it. Underside of non-hyaline terminal area dark brown anterior of vein *M* on each wing and at tornus of fore wing; remainder light buff.

In some examples (Pl. 110, fig. 985) the non-hyaline terminal area is narrow and the subterminal fascia unmarked; the genitalia of both sexes of this form appear to be identical with those of the typical.

♂ genitalia (Text-figs 244, 245). Arms of gnathus slender and fused medially; ventral plate not developed. Valve simple, apex narrowly rounded; dorsal process dilate and setose in basal third. Ventral surface of aedeagus with a pair of lobate processes at two-thirds and a slender, weakly sclerotized rod-like process extending apicad. Fulcrum narrowly rounded at apex. Vesica with an arcuate, tapered cornutus with a barbed apex.

♀ genitalia (Pl. 52, figs 658, 659). Operculum V-shaped and covered ventrally with a crenulate, membranous pocket. Ductus seminalis dilate and coiled.

Measurements. Fore wing: ♂ ♀ 11–12 mm. Antennal pectinations: ♂ 12 ×, ♀ 4–5 × diameter of shaft.

Distinguished externally from other small species occurring in West Africa by the absence of discal spots. In the male genitalia the form of the aedeagus and cornutus and in the female genitalia the form of the sterigma with its crenulate, membranous pocket are diagnostic.

DISTRIBUTION. West Africa, Senegal to Cameroun.

#### MATERIAL EXAMINED.

*Zamarada dilucida* Warren, holotype ♂, NIGERIA ('West Africa'): Lagos, Geometridae genitalia slide no. 6366, in BMNH.

SENEGAL: Sedhiou, iii, v–viii (*H. Castell*), 10 ♂, 18 ♀. GAMBIA: (*A. Moloney*), 1 ♂; Bathurst, 4 ♂ (all BMNH). GUINEA: Beyla (*Dr Mir. Mrázek*), 3 ♀ (MM, Brno); Dalaba, 10.v.1954 (*M. Vintejoux*), 1 ♂; Tondon, 60 km N.O. of Kindia (*L. Labour*), 2 ♀; Tondon, Cercle de Dubreka (*L. Labour*), 1 ♂ (all coll. Herbulot, Paris). SIERRA LEONE: 1915 (*A. Bacot*), 3 ♂; ibidem (*A. B. Frere*), 1 ♀; Freetown, 1889 (*A. Mocquers*), 1 ♀; Freetown, 8.x–19.xi.1968 (*D. F. Owen*), 2 ♂, 1 ♀; Bo, xii. 1967 (*R. Revell*), 1 ♂ (all BMNH). IVORY COAST: Korhoga, viii. 1964 (*P. Griveaud*), 1 ♂; Reserve de Bouna, xi. 1965 (*P. Griveaud*), 1 ♂; Lamto, 36 km N.N.W. de Tiassalé, 20–24.iv.1969 (*C. Herbulot*), 1 ♂, 1 ♀ (all coll. Herbulot, Paris). GHANA: N. Territories, Kete-Krachi (*A. W. Cardinall*), 2 ♂, 7 ♀; Bolgatanga, v. 1962 (*D. J. Lewis*), 1 ♀. NIGERIA: Zungeru, 31.iii–21.iv.1911 (*Scott Macfie*), 5 ♀; Baro, 6.ix.1910 (*Scott Macfie*), 1 ♀; Zaria, Samaru, 11–18.viii.1966 (*J. Deeming*), 2 ♂, 1 ♀; Kaduna, v. 1960 (*J. Boorman*), 1 ♀; Jos, vi. 1960 (*J. Boorman*), 1 ♂, 3 ♀; Jos, 21.iii.1958 (*J. D. B. Perkins*), 1 ♀; Niger, Borgu, Yelwa (*Wilson*), 1 ♀; Lokoja, x. 1904, rainy season (*D. Cator*), 1 ♀; Makurdi, iii–viii. 1952 (*A. W. Pring*), 1 ♂. CAMEROUN: Fôret de Bafut Nguemba, 9 km S.E. de Bamenda 2080 m, 3–5.iv.1972 (*C. Herbulot*), 1 ♂ (coll. Herbulot, Paris).

#### THE *LEPTA*-GROUP

Placed near the *excavata*-group because of habitus and the form of slender, tapered uncus.

In the male genitalia the valves are symmetrical, each is tapered to a spatulate apex or the apical third is incurved towards the uncus and has a spatulate apex;



membranous, setose projection from near base of dorsal process abnormally large. Fulcrum scobinate at apex. Ventral plate of gnathus developed. The male hind tibia is dilate with a hair-pencil.

#### KEY TO SPECIES

- 1 Valve straight, apical third narrowed to width of apical half of fulcrum; apex spatulate and narrowly rounded; dorsal process with broad-based, setose projection from basal third . . . . . *lepta* (p. 146)  
 - Apical third of valve incurved through 90 degrees towards uncus and spatulate to rounded apex; dorsal process with a long, digitate, setose projection from near base . . . . . *suda* (p. 147)

#### *Zamarada lepta* sp. n.

(Text-figs 246, 247; Pl. 51, figs 654, 655; Pl. 110, fig. 987)

♂ ♀ (Pl. 110, fig. 987). Hyaline area of wings tinged with yellow and sparsely striate with grey proximally; discal spots black, minute and sharply marked. Non-hyaline terminal area of each wing greyish red (pl. 8, C5); dentate subterminal fascia brownish orange, sharply defined; cilia chequered greyish yellow and grey. Underside of non-hyaline terminal area of wings similar to that of *dilucida*.

♂ genitalia (Text-figs 246, 247). Uncus tapered and curved ventrad. Arms of gnathus slender, ventral plate developed. Valve slender and straight, apical half narrowed to width of apical half of fulcrum, apex spatulate and narrowly rounded; slender dorsal process with a broad-based, setose projection from basal third. Aedeagus tapered to a weakly sclerotized apex; basal two-thirds sclerotized in longitudinal rib-like form. Fulcrum strongly sclerotized, extending beyond tip of aedeagus, the tip spatulate and scobinate. Vesica without a cornutus.

♀ genitalia (Pl. 51, figs 654, 655). Lamella antevaginalis rectangular, the outline strongly sclerotized, that of the posterior margin irregular; medial area weakly sclerotized. Corpus bursae very slender, sclerotized posteriorly.

Measurements. Fore wing: ♂ ♀ 11–13 mm. Antennal pectinations: ♂ 16 ×, ♀ 4 × diameter of shaft.

Similar in size and pattern to one of the small West African species in the *excavata*-group, *lophobela*, and to *fibulata*, *ostracodes* and *melanopyga* in the *protrusa*-group, but distinguished by the greyish red rather than the greyish brown colour of the non-hyaline terminal area of the wings; the three species from the *protrusa*-group may be further distinguished in the male by the presence of a simple hind tibia.

Distinguished externally from the closely similar *dilucida* by the redder non-hyaline terminal area of the wings, the markedly reduced grey striation of the hyaline area and by the presence of discal spots.

In the male genitalia the form of the tapered, spatulate valve and in the female genitalia the form of the sterigma and slender corpus bursae are diagnostic.

DISTRIBUTION. Sierra Leone, Liberia, Ivory Coast, Ghana, Nigeria, Cameroun, Angola, Uganda.

Holotype ♂, SIERRA LEONE: Freetown, 8.x–19.xi.1968 (*D. F. Owen*), Geometridae genitalia slide no. 7144, in BMNH.

Paratypes. SIERRA LEONE: (*Major Bainbridge*), 1 ♀; Bo (*R. Revell*), 1 ♀; holotype data, 3 ♀. LIBERIA: Nimba, Grassfield, vii-viii (*A. Forbes-Watson*), 1 ♀. IVORY COAST: Bingerville, 1915 (*G. Melou*), 1 ♂, 2 ♀; ibidem, 25.v-3.vi.1915, 1 ♀; vi. 1915, 1 ♀; 1-7.vi.1915, 1 ♂; 8.vi.1915, 1 ♀; 11.vi.1915, 2 ♀; 20-24.vi.1915, 1 ♀; 1-7.vii.1915, 1 ♀ (all BMNH); Yapo-Sud, 22 km S.S.E. Agboville, 12-18.iv.1969 (*C. Herbulot*), 1 ♀ (in coll. Herbulot, Paris). GHANA: Aburi, xi. 1901 (*W. H. Johnson*), 1 ♀. NIGERIA: Warri, v. 1897 (*Dr Roth*), 1 ♀; Niger, Degama (*Dr Ansorge*), 1 ♀; Itu, 5.ii.1910 (*Farquahar*), 2 ♀; Ilesha (*Capt. Humfrey*), 1 ♀ (all BMNH). CAMEROUN: N'Kolbisson, 700 m, 15-21.iv.1972, 4 ♂, 2 ♀; Mont Kala, 18 km W. de Yaoundé, 1120 m, 20.iv.1972, 1 ♀ (all *C. Herbulot*, in coll. Herbulot, Paris). ANGOLA: Amboim district, Fazenda Congulu, 7-800 m, 7-11.iv.1934 (*Dr K. Jordan*), 3 ♀; ibidem, 12-16.iv.1934, 1 ♂ (all BMNH). UGANDA: Bwamba Forest, 2500 ft, iii. 1943 (*J. G. Williams*), 1 ♀ (BMNH); Entebbe, xi. 1962 (*E. S. Brown*), 1 ♂ (NMK, Nairobi); Entebbe, vi. 1961, 1 ♂ (NMR, Bulawayo); Kampala, ii. 1953 (*D. G. Sevastopulo*), 1 ♀; ibidem, iv. 1953, 1 ♂ (all NMK, Nairobi); ibidem, 8.iii.1953, 1 ♀ (BMNH).

### *Zamarada suda* sp. n.

(Text-figs 248, 249; Pl. 51, figs 656, 657; Pl. 110, fig. 986)

♂ ♀ (Pl. 110, fig. 986). Hyaline area of each wing weakly tinged with yellow, very sparsely striate with vinaceous-tinged grey on posterior margin and very finely edged distally with yellow and brown; dark discal spots minute. Non-hyaline terminal area reddish grey (pl. 8, B2) sparsely irrorate with brown; dentate subterminal fascia brownish orange, tip of each dentation brown; cilia chequered buff and grey. Underside of non-hyaline terminal area greyish brown, fading to greyish orange in posterior half of hind wing.

♂ genitalia (Text-figs. 248, 249). Uncus short and tapered. Ventral plate of gnathus rounded at tip, minutely and densely scobinate. Apical third of valve incurved through 90 degrees towards uncus to rounded, spatulate apex; dorsal process with a long, setose, digitate projection near base. Aedeagus tapered to narrowly rounded apex. Fulcrum compressed laterally at apex, dorsal and apical margins serrate.

♀ genitalia (Pl. 51, figs 656, 657). Posterior margin of lamella antevaginalis shallowly bilobate; lateral and anterior margins evenly curved and conspicuously more strongly sclerotized than remainder of plate; lamella postvaginalis membranous. Slender corpus bursae sclerotized posteriorly.

Measurements. Fore wing: ♂ 13.0-15.5 mm; ♀ 13-15 mm. Antennal pectinations: ♂ 9 ×, ♀ 2 × diameter of shaft.

Closely similar in colour and pattern to several species in the *excavata*-group, *excavata*, *corymbophora* and *subinterrupta* and to *protrusa* in the *protrusa*-group. Distinguished from *excavata* by the strongly marked subterminal fascia and in the male by the presence of a dilate hind tibia; from *corymbophora* by the paler, clearer hyaline area of the wings and in the male by the absence of specialized scales on the hind coxa; from *subinterrupta* by the differently shaped, smoother hyaline excavations of the terminal area of each wing and in the male by the presence of a dilate hind tibia; and from *protrusa* by the anteriorly inclined, sloping

lower margin of the hyaline excavation of the fore wing and in the male by the presence of a dilate hind tibia.

Distinguished externally from *lepta*, with which it is tentatively associated, by its larger size and differently shaped hyaline excavations of the terminal area. In the male genitalia the form of the valve is clearly diagnostic; the rather similar female genitalia are distinguished by the form of the sterigma and signum.

DISTRIBUTION. Ivory Coast, Nigeria, Cameroun, Gabon, Zaïre.

Holotype ♂, CAMEROUN ('Kamerun'): Efulen, 4.iv.1923 (*H. L. Weber*), in CM, Pittsburgh.

Paratypes. IVORY COAST: Yapo-Sud, 22 km S.S.E. of Agboville, 12-18.iv.1969 (*C. Herbulot*) 1 ♂, 1 ♀ (in coll. Herbulot, Paris). NIGERIA: Kwali (*F. W. Sampson*), 1 ♀; Niger, Degama (*Dr Ansorge*), 1 ♂; Omo, vii. 1960 (*J. Boorman*), 1 ♂ (BMNH). CAMEROUN: N'Kongsamba, 1.iv.1958 (*P. Darge*), 1 ♂; Savanes d'Akak, 14 km N.N.E. of Yaoundé, 9.ix.1971 (*P. Darge*), 1 ♀; N'Kolbisson [7 km W. de Yaoundé] 15-18.iv.1972 (*C. Herbulot*), 1 ♂, 3 ♀; M'Balmayo, Ecole forestière, 11.ix.1971 (*P. Darge*), 1 ♂; 6 km N.E. d'Edea, 28-29.iii.1970 (*C. Herbulot*), 1 ♂, 1 ♀; 8 km N. d'Edea, 30.iii-1.iv.1970 (*C. Herbulot*), 1 ♂ (all coll. Herbulot, Paris); Johann-Albrechts Höhe, 8.v.1896 (*L. Conradt*), 1 ♀; ibidem, 1896-98, 2 ♂, 1 ♀; Lolodorf, 1894-1895 (*L. Conradt*), 1 ♀ (all BMNH); Efulen, 8-13.ii (*H. L. Weber*), 1 ♂, 1 ♀; ibidem, 15-27.iii.1923, 2 ♂, 2 ♀; 4-21.iv.1923, 6 ♂, 1 ♀; 12-24.v., 1 ♂, 1 ♀; 10.vi.1913, 1 ♀ (all CM, Pittsburgh); Efulen, 29.iv.1926 (*G. Schwab*), 1 ♀; Bitje, Ja River, x, wet season (*G. L. Bates*), 1 ♀ (all BMNH). GABON: Belinga, Camp Central, 500 m, 22.iii.1963, 1 ♂; Belinga, Grande Crête Sud, 19.iii.1963, 1 ♂; Belinga, Piste de Mwadi, 800 m, 20.iii.1963, 1 ♀ (all *G. Bernardi*, in MBG, Paris); Mouila, 3.x.1964 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris). ZAIRE ('Belgian Congo'): Lulua, Kafakumba, xii. 1933 (*G. Overlaert*), 1 ♂ MRAC, Tervuren; E. Upper Ituri Valley, 30 miles S. of Irumu, 3000 ft, tropical forest, vii. 1924 (*T. A. Barns*), 1 ♂ (BMNH).

### THE *NASUTA*-GROUP

Characterized in the male genitalia by the weakly sclerotized asymmetrical valves and the large bilobate juxta, a structure usually weakly developed in *Zamarada*. The male hind tibia is simple.

In the female genitalia the sterigma is weakly developed; the lamella antevaginalis is small and tapered posteriorly.

The precise affinities of the sole included species have not been established and it has been placed next to the *lepta*-group because of the similarities of habitus.

### *Zamarada nasuta* Warren

(Text-figs 250-251A; Pl. 52, figs 660, 661; Pl. 112, fig. 1015)

[*Comibaena reflexaria* Walker, [1863] 1862: 1565, paralectotype. Misidentification.]  
*Zamarada nasuta* Warren, 1897: 122. Holotype ♀, NIGERIA (BMNH) [examined].  
*Zamarada nasuta* Warren; Swinhoe, 1904: 515 (part).

♂ ♀ (Pl. 112, fig. 1015). Hyaline area of wings tinged with pale yellow, free from dark irroration; discal spots dark grey. Costa of fore wing pale yellow, immaculate; basal area of fore wing and non-hyaline terminal area of each wing reddish brown (pl. 9 D4) very lightly irrorate with reddish golden (pl. 6, C7) and dark brown (pl. 6, F5, teak); dentate subterminal fascia strongly marked, dark brown mixed with reddish golden and finely edged distally with pale buff; cilia greyish orange.

♂ genitalia (Text-figs 250-251A). Uncus tapered, tip produced and bluntly rounded. Ventral plate of gnathus well developed, asymmetrical and tapered to a narrowly rounded tip inclined to the right side. Juxta very large for *Zamarada*, bilobate at apex. Valves asymmetrical; dorsal process simple, without projection. Aedeagus slightly spiral in shape. Fulcrum subequal in length to aedeagus. Vesica without cornutus.

♀ genitalia (Pl. 52, figs 660, 661). Sterigma weakly developed; lamella antevaginalis tapered posteriorly to rounded tip. Corpus bursae wholly membranous.

Measurements. Fore wing: ♂ 10-11 mm; ♀ 9.5-12.0 mm. Antennal pectinations: ♂ 13 ×, ♀ 5 × diameter of shaft.

Externally closely similar to *lepta*, but distinguished by its slightly smaller size, darker non-hyaline terminal area of each wing, greyish orange unchequered cilia and, in the male, by the simple hind tibia. In the male genitalia the large, bilobate juxta and the form of the asymmetrical valves and in the female the form of the weakly developed sterigma are diagnostic.

Male specimens from Efulen in Cameroun and from Entebbe in Uganda differ in the more deeply cleft apex of the left valve and in the longer right valve (Text-fig. 251). Externally the Cameroun specimens are closely similar to typical *nasuta*; those from W. Uganda are slightly larger (♂ ♀ fore wing 13 mm) and of a redder grey in the non-hyaline terminal area, closely resembling *lepta*, with which they occur.

BIOLOGY. A male specimen was reared in Ghana by G. S. Cotterell from a larva feeding on *Dichrostachys glomeratus* (Forsk.) Chiov. (= *D. cinerea* (Linnaeus) Wight & Arnott) (Leguminosae).

DISTRIBUTION. West Africa, Senegal to Cameroun, Niger, Sudan, Uganda.

#### MATERIAL EXAMINED.

*Zamarada nasuta* Warren, holotype ♀, NIGERIA: Lokoja, R. Niger (*A. Cook*), with wrong abdomen glued on, in BMNH.

SENEGAL: Sédhio, i, iii, vi, viii (*H. Castell*), 3 ♂, 15 ♀. GAMBIA: (*Carter*), 2 ♂, 1 ♀; Bathurst, 1 ♂. GUINEA: Beyla (*Dr Mir. Mrázek*), 2 ♂, 1 ♀ (MM, Brno); Kankan, 1200 ft, 19.iv.1926 (*C. L. Collenette*), 1 ♀. MALI: Koulikoro, 1 ♀. SIERRA LEONE: pre-1838 (*Rev. D. F. Morgan*), 1 ♀ (*Comibaena reflexaria* Walker, paralectotype) [misidentification]; ibidem (*H. A. Thorne*), 1 ♀; Hill Station, xi-xii. 1933 (*M. Frere*), 2 ♂, 2 ♀; Freetown (*F. Smith*), 1 ♂; ibidem, 1898 (*A. Mocquerys*), 1 ♂, 1 ♀; ibidem, 16.vi.1917 (*P. A. Buxton*), 1 ♂; ibidem, 8.x-19.xi.1968 (*D. F. Owen*), 1 ♂ (all BMNH). IVORY COAST: 1 ♂, 2 ♀ (BMNH); Lamto, 36 km N.N.W. of Tiassalé, 20-23.iv.1968 (*C. Herbulot*), 2 ♂, 5 ♀ (in coll. Herbulot, Paris). GHANA: Gambaga (*Dr Bury*), 1 ♂, 1 ♀; Bolgatanga, iv-v. 1962 (*D. J. Lewis*), 2 ♀; Northern Territories, Navaro (11°0' N. 1°30' W.), ii. 1923 (*A. W. Cardinall*), 1 ♀; ibidem, viii. 1923, 1 ♂, 1 ♀; Kete-Krachi (*A. W. Cardinall*), 7 ♀; Accra plains, vii. 1931, larva feeding on



*Dichrostachys glomeratus* (G. S. Cotterell), 1 ♂. NIGER: S. Damagarim, Bande, 16.ix.1920 (A. Buchanan), 1 ♂. CENTRAL AFRICAN REPUBLIC: Fort Crampel, 1 ♀. SUDAN: Wau, 1 ♂ (ZSBS, Munich). TOGO: Misahöhe, 1893 (E. Baumann), 1 ♂. NIGERIA: Massarawa Pr., Izom, Gbari, 5.vii.1921 (C. R. Walker), 1 ♂ (UM, Oxford); Zaria, Samaru, 11.viii.1966 (J. Deeming), 2 ♂; ibidem, x. 1967, 1 ♂, 1 ♀; Zungeru, ii-iv. 1911 (Scott Macfie), 1 ♂, 2 ♀; Bodeggi, 19.ix.1910 (Scott Macfie), 1 ♂; Jos, vi. 1960 (J. Boorman), 1 ♂; Ibadan, 19.v.1958 (H. J. Sutton), 1 ♂; River Benue, Abinsi, v, vii, 2 ♀ (all BMNH); Lagos, ix. 1910 (J. A. de Gaye), 2 ♂ (UM, Oxford); Agouë (Benin), 1894 (Abbé Menager), 1 ♀; Olokemeji, v. 1908 (G. C. Dudgeon), 1 ♂; Akassa-Onitsha, R. Niger (Dr Cook), 1 ♀ (all BMNH). CAMEROUN: Efulen, v-vi (H. L. Weber), 1 ♂, 2 ♀ (CM, Pittsburgh). UGANDA: Entebbe, iii. 1961 (N. Mitton), 1 ♂, 1 ♀ (NMK, Nairobi); ibidem, vii. 1961, 2 ♂ (NMR, Bulawayo).

### THE VULPINA-GROUP

Characterized in the male genitalia by the bifurcate fulcrum, each of the two parallel parts being blade-like. Uncus short and tapered, base bulbous and dorsally setose. Ventral plate of gnathus developed. Vesica without cornutus.

The male hind tibia is not dilate, but encloses a compact tuft of fine hair-scales, which can be extruded through a circular opening at about mid-tibia. The capsule-like tuft is equal in length to the greatest width of the tibia; readily visible in cleared and slide-mounted material only.

In the female genitalia the lamella antevaginalis is weakly sclerotized and bilobate just anterior of operculum; remainder of sterigma membranous.

### KEY TO SPECIES

- |       |                                                                                                                                                                                                                                                      |   |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 1     | Non-hyaline area of wings broad; hyaline area not extending distad beyond two-thirds of wing between veins $M_3$ and $Cu_{1b}$ . Apex of aedeagus smoothly tapered                                                                                   | 2 |
| -     | Hyaline area of wings extending to or beyond five-sixths of wing between veins $M_3$ and $Cu_{1b}$ . Apex of aedeagus with small, thorn-like projection                                                                                              | 3 |
| 2 (1) | Discal spot ovate with pale hyaline centre; remainder of hyaline area striate with brownish orange. Twin blades of fulcrum with rounded apices <i>saburra</i> (p. 155)                                                                               |   |
| -     | Very large, round discal spot uniformly brownish orange; spot of similar size and colour at one-third posterior margin of each wing. Twin blades of fulcrum with truncate and serrate apical margins . . . . . <i>dialitha</i> (p. 154)              |   |
| 3 (1) | Valve of even width to truncate apex; apex of ventral margin abruptly curved through 90 degrees. Subterminal fascia unbroken between veins $M_3$ and $Cu_{1b}$ . Discal spot on fore wing usually as broad as abdomen                                |   |
| -     | Valve tapered apicad; ventral margin evenly curved towards apex of dorsal margin. Subterminal fascia broken by intrusion of hyaline area between veins $M_3$ and $Cu_{1b}$ . Discal spot on fore wing minute . . . . . <i>bastelbergeri</i> (p. 153) | 4 |
| 4 (3) | Blades of fulcrum very slightly asymmetrical, finely tapered and both extending beyond tip of aedeagus. Non-hyaline terminal area of wings predominantly reddish golden to greyish red . . . . . <i>vulpina</i> (p. 151)                             |   |
| -     | Blades of fulcrum markedly asymmetrical, tapered but not finely so; shorter blade extending to tip of aedeagus, but not beyond. Non-hyaline terminal area of wings predominantly brownish grey . . . . . <i>longidens</i> (p. 152)                   |   |

*Zamarada vulpina* Warren

(Text-figs 252, 253; Pl. 53, figs 662, 663; Pl. 110, figs 988, 989)

*Zamarada vulpina* Warren, 1897 : 123. Holotype ♂, NIGERIA (BMNH) [examined].*Zamarada erni* Strand, 1915 : 179, text-fig. 5. Holotype ♀, CAMEROUN (DEI, Eberswalde) [examined].

♂ ♀ (Pl. 110, figs 988, 989). Hyaline area of wings tinged with yellow, slenderly edged distally with pale yellow (pl. 4, A3) and then reddish golden (pl. 6, C7); discal spots minute. Dentate subterminal fascia pale yellow, strongly marked and broadened between costa and vein  $M_1$  on each wing; edged proximally and distally with reddish golden; each wing uniformly greyish red (pl. 7, B3) proximad of subterminal fascia, pale yellow irrorate with greyish red distad of it; termen slenderly reddish golden; cilia chequered pale yellow and greyish red. Underside of non-hyaline terminal area light buff edged proximally with brown, broadly in apical half of fore wing, narrowly in apical half of hind wing; a brown spot only at tornus of fore wing and at anal angle of hind wing; termen slenderly brown.

♂ genitalia (Text-figs 252, 253). Ventral plate of gnathus rounded at tip. Ventral margin of valve weakly serrate apicad and curved to apex of dorsal margin. Aedeagus with small thorn-like projection at one side of apex. Blades of fulcrum slightly asymmetrical, both extending beyond tip of aedeagus.

♀ genitalia (Pl. 53, figs 662, 663). Ostium bursae with slender, sclerotized collar. Corpus bursae with a sclerotized, finger-like extension from ductus bursae inclined towards stellate signum situate in anterior third.

Measurements. Fore wing: ♂ 12–14 mm; ♀ 12–15 mm. Antennal pectinations: ♂ 14 ×, ♀ 4 × diameter of shaft.

Distinguished externally by the pale yellow, dentate subterminal fascia, strongly marked on each wing between the costa and vein  $M_1$ , and by the uniformly greyish red area proximad of it. Specimens from Mt Selinda in Rhodesia have a yellower tone to the hyaline area of the wings and the extension of this area into the patterned distal third is broader and deeper and the discal spot is larger (Pl. 110, fig. 989); in these respects they resemble *longidens*, but in colour they accord well with *vulpina*.

In the male genitalia the blade-like halves of the fulcrum are almost equal in length in those West African examples examined; in East African examples they are slightly asymmetrical. Their length in relation to the aedeagus, however, distinguishes *vulpina* from *longidens*.

In the female genitalia the finger-like sclerotized pattern on the corpus bursae is more strongly marked and more sharply defined in those West African examples examined than in those from East African localities; the latter appear to be indistinguishable from *longidens*.

DISTRIBUTION. Equatorial Africa.

## MATERIAL EXAMINED.

*Zamarada vulpina* Warren, holotype ♂, NIGERIA: Warri, Niger C.P., vi. 1896 (*Dr Roth*), Geometridae genitalia slide no. 4357, in BMNH. *Zamarada erni* Strand, holotype ♀, CAMEROUN ('Kamerun'): Bonaberi, xi–xii. 1910 (*Hintz*), in DEI, Eberswalde.

GUINEA: Beyla (*Dr Mir. Mrázek*), 1 ♀ (MM, Brno); Mt Nimba, vii–xii. 1951

(*Lamotte et Roy*), 1 ♂ (coll. Herbulot, Paris). SIERRA LEONE: Bo, xii. 1968 (*R. Revell*), 1 ♀. IVORY COAST: Bingerville, xi. 1913 (*G. Melou*), 1 ♀. NIGERIA: 70 miles E. of Lagos (*W. A. Lamborn*), 1 ♀; Benin City, 200 ft, 27.ii.1902 (*C. M. J. Gordon*), 1 ♀ (both UM, Oxford); Ilesha (*L. E. H. Humfrey*), 1 ♀; Sapele (*F. W. Sampson*), 1 ♀; Agberi, 12.viii.1901 (*Ansorge*), 1 ♀; Degama (*Dr Ansorge*), 1 ♀ (all BMNH). CAMEROUN: Buea, 1 ♀; Efulen, v, vi, vii, x (*H. L. Weber*), 4 ♂ (all CM, Pittsburgh); ibidem, 17.iv.1926 (*G. Schwab*), 1 ♀; Johann-Albrechts Höhe, 1898 (*L. Conradt*), 1 ♂; Bitje, Ja River, x, wet season (*G. L. Bates*), 1 ♂ (all BMNH). GABON: Mouila, 12.x.1964 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris). ZAIRE ('Belgian Congo'): Lusambo, 15.vi.1949 (*Dr M. Fontaine*), 1 ♂; Sankuru, Katako-Kombe, 21.v.1952 (*Dr M. Fontaine*), 1 ♂; ibidem, 13.x.1952, 1 ♂ (all MRAC, Tervuren); Kasai, Lodja, iii. 1959 (*R. H. Carcasson*), 1 ♂ (NMK, Nairobi); Yakusu (*K. Smith*), 1 ♂ (BMNH); Uele, Paulis, 18.xi.1955 (*Dr M. Fontaine*), 1 ♀ (MRAC, Tervuren); E. Ituri Valley, 30 miles S. of Irumu, 3000 ft, vii. 1924 (*T. A. Barnes*), 1 ♂; W. Kivu, Upper Lova Valley, near Masisi, 5-6000 ft, ii. 1924, wet season (*T. A. Barnes*), 1 ♂ (both in BMNH). UGANDA: Bwamba, vi. 1956 (*N. Mitton*), 1 ♂ (NMK, Nairobi). KENYA: Shimba Hills, xii. 1961 (*R. H. Carcasson*), 2 ♂, 1 ♀ (NMK, Nairobi). TANZANIA: Amani, xi-xii (*G. Pringle*), 1 ♂, 3 ♀ (BMNH); ibidem, xi. 1965 (*R. H. Carcasson*), 3 ♂ (NMK, Nairobi). MALAWI: Lintipe River (15°19' S. 35°04' E.), 2500 ft, xii. 1915 (*C. Mason*), 1 ♀ (UM, Oxford); Mlanji Boma, 2400 ft, 26.iv.1910 (*S. A. Neave*), 1 ♂; Zomba District, Likomgala River, i. 1922 (*H. Barlow*), 1 ♀ (both BMNH). RHODESIA: Mt Selinda, 9-17.iv.1956 (*van Son & Vári*), 6 ♂, 4 ♀ (TM, Pretoria); Vumba, 10.i.1959 (*B. D. Barnes*), 1 ♂; ibidem, 15.v.1956, 1 ♂ (both NMR, Bulawayo). MOZAMBIQUE: Serra Rotanda, E. of Chimanimoni Mts, 1-8.iii.1970 (*E. Pinhey*), 1 ♂, 1 ♀ (NMR, Bulawayo).

### *Zamarada longidens* Fletcher

(Text-figs 254, 255; Pl. 110, fig. 990)

*Zamarada longidens* Fletcher, 1963: 34, figs 20, 45, 75. Holotype ♂, UGANDA (BMNH) [examined].

♂ ♀ (Pl. 110, fig. 990). Closely related to *vulpina*, from which it differs externally in having a white instead of yellow subterminal fascia; in the darker colour of the non-hyaline terminal area, which proximad of the subterminal fascia is brownish grey (pl. 11, D2); in the more extensive intrusion of the green-tinged hyaline area between veins  $M_3$  and  $Cu_{1b}$ , where it reaches the termen.

♂ genitalia (Text-figs 254, 255). Differ from those of *vulpina* in the shorter, broader, markedly asymmetrical blade-like halves of the fulcrum, the shorter part not extending beyond the tip of the aedeagus.

♀ genitalia. Closely similar to those of *vulpina*.

Measurements. Fore wing: ♂ 14-15 mm; ♀ 14 mm. Antennal pectinations: ♂ 13 × 3 × diameter of shaft.

DISTRIBUTION. E. Zaire, Uganda, Kenya.

### MATERIAL EXAMINED.

*Zamarada longidens* Fletcher, holotype ♂, UGANDA: south-west, Kigezi District, Impenetrable Forest, Kanungu, 4500 ft, v. 1952 (*J. A. Burgess*), in BMNH.

ZAIRE ('Belgian Congo'): Kivu, Nyamunyunge (Mulungu), 4.xii.1955 (*J. Hecq*), 1 ♂ (MRAC, Tervuren); Parc National Albert, massif Ruwenzori, Kyandolire, 1700 m, camp des Gardes, 7.x.1952, 1 ♂ (IPN, Brussels); Kalonge, 2210 m, 20.viii.1952, 1 ♂ (BMNH); Kiala, 1.viii.1929, 1 ♀ (BMNH); Kiala (Kyala), 31.vii.1929 (*J. Romieux*), 1 ♀ (MHN, Geneva). UGANDA: holotype data, 2 ♂ (BMNH); Kigezi, Mafuga Forest, 7500–8000 ft, vi. 1951 (*T. H. E. Jackson*), 1 ♂; Ankole, Kalinzu Forest, xi. 1961 (*R. H. Carcasson*), 1 ♂ (both NMK, Nairobi); Kawanda Research Station, 5.xii.1969 (*D. N. McNutt*), 1 ♂; ibidem, 12.i.1970, 1 ♂ (both BMNH). KENYA: Kakamega, iii. 1966 (*R. H. Carcasson*), 1 ♂ (NMK, Nairobi).

### *Zamarada bastelbergeri* Gaede

(Text-figs 256, 257; Pl. 53, figs 664, 665; Pl. 110, fig. 991)

*Zamarada bastelbergeri* Gaede, 1915 : 118, pl. 2, fig. 13. Holotype ♀, CAMEROUN (MNHU, Berlin) [examined].

*Zamarada flavicincta* Hampson ab. 1, Hampson, 1910 : 471.

*Zamarada flavicincta* Hampson ab. *nigericola* Strand, 1917 : 10. Holotype ♀, NIGERIA (BMNH) [examined].

*Zamarada acichemena* Prout, 1934a : 95. Holotype ♀, ZAIRE (MRAC, Tervuren) [examined].

*Zamarada bastelbergeri* Gaede; Herbulot, 1954 : 327.

♂ ♀ (Pl. 110, fig. 991). Hyaline area of wings yellowish grey slenderly edged distally with dark brown and sometimes irrorate with brownish grey at posterior margin of fore wing and medially on hind wing; discal spot on fore wing usually as broad as abdomen. Subterminal fascia yellow, edged proximally with reddish orange, dentate and usually entire and evenly marked; remainder of non-hyaline terminal area of each wing brownish grey (pl. 11, D2) proximad of subterminal fascia, brownish orange to reddish golden (pl. 6, C6, 7) irrorate with brownish grey distad of it; cilia chequered yellow and brownish orange. Underside of non-hyaline terminal area buff to grey, densely suffused with brown proximad of light buff subterminal fascia, especially in anterior half of each wing.

♂ genitalia (Text-figs 256, 257). Valve of even width, apex of ventral margin abruptly curved through 90 degrees, apex of dorsal margin shortly produced, tapered and sclerotized. The two blade-like halves of the fulcrum are tapered, almost of equal length and extend beyond the tip of the aedeagus.

♀ genitalia (Pl. 53, figs 664, 665). Similar to those of *vulpina* and *longidens*, differing in the shorter and broader corpus bursae, which is more strongly sclerotized posteriorly and has the signum situate medially.

Measurements. Fore wing: ♂ 13–14 mm; ♀ 12–13 mm. Antennal pectinations: ♂ 15 ×, ♀ 4 × diameter of shaft.

Distinguished from *vulpina* and *longidens* by the appreciably broader non-hyaline terminal area of each wing; by the evenly marked, entire, dentate subterminal fascia, not broadened between the costa and vein  $M_1$  on the fore wing, and by the presence of a large discal spot on the fore wing. Distinguished in the male genitalia by the form of the valve and in the female genitalia by the shape of the corpus bursae and the position of the signum.

DISTRIBUTION. Guinea, Nigeria, Cameroun, Gabon, Zaire, W. Uganda.



## MATERIAL EXAMINED.

*Zamarada bastelbergeri* Gaede, holotype ♀, CAMEROUN ('Neu-Kamerun'): Niger-Benue Dampferfahrt (*Houy*), in MNHU, Berlin. *Zamarada flavicincta* Hampson ab. *nigericola* Strand, holotype ♀, NIGERIA: south, Abutshi (*P. H. Newman*), in BMNH. *Zamarada acichemena* Prout, holotype ♂, ZAIRE ('Belgian Congo'): Sankaru, Komi, ix-x. 1929 (*J. Ghesquière*), in MRAC, Tervuren.

NIGERIA: Agberi, 13.ix.1901 (*Ansorge*), 1 ♀; Iju, vii. 1960 (*J. Boorman*), 1 ♀; Calabar, ii. 1961 (*G. Markham*), 1 ♂. CAMEROUN: Efulen, iii, vi (*H. L. Weber*), 2 ♂ (CM, Pittsburgh). GABON: Mouila, 25.ix.1964 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris). ZAIRE ('Belgian Congo'): Equateur, Ikela, Loile River, iv. 1959 (*R. H. Carcasson*), 1 ♂ (NMK, Nairobi); Lulonga, Befale, 15.ix.1927 (*J. Ghesquière*), 1 ♀ (MRAC, Tervuren); Ukakuraka (1°56' N. 20°24' E.), 29.xii.1948 (*T. Wikely*), 1 ♀ (BMNH); Lowa, 10.x.1955 (*F. G. Overlaert*), 1 ♀; Lunsele (5°0' S. 23°34' E.), 11.ix.1950 (*P. Hostie*), 1 ♂; Sankaru, Katako-Kombe, 22.vi.1952 (*Dr M. Fontaine*), 1 ♂; ibidem, 21.xii.1951, 1 ♂ (all MRAC, Tervuren); W. Kivu, Ibanda, 1938 (*Vandelanoitte*), 1 ♀ (BMNH). UGANDA: Toro, Kibale Forest, v. 1966 (*R. H. Carcasson*), 1 ♂ (NMK, Nairobi); Masaka, Sango Bay, Katera, xi. 1954 (*T. H. E. Jackson*), 1 ♂ (BMNH).

*Zamarada dialitha* sp. n.

(Text-figs 258, 259; Pl. 54, figs 666, 667; Pl. 110, fig. 993)

♂ ♀ (Pl. 110, fig. 993). Hyaline area of wings greyish yellow (pl. 3, B5, wax-yellow), not extending distad beyond two-thirds of wing between veins  $M_3$  and  $Cu_{1b}$ ; costa of fore wing, large discal spot extending to costa and large spot and posterior margin of each wing brownish orange; the two large spots are joined on the hind wing in some examples. Dentate subterminal fascia light buff; remainder of wings greyish orange (pl. 6, B6-7) suffused with brownish orange to reddish golden (pl. 6, C5-6) proximad of subterminal fascia. Underside of non-hyaline area of wings uniformly brownish orange (pl. 5, C4).

♂ genitalia (Text-figs 258, 259). Valve slightly tapered apicad; apex of dorsal margin produced, tapered and sclerotized with a slight ridge below tip. Twin blades of fulcrum with truncate and serrate apical margins.

♀ genitalia (Pl. 54, figs 666, 667). Corpus bursae long and slender, weakly sclerotized in posterior tenth; stellate signum situate in anterior fifth.

Measurements. Fore wing: ♂ 15-16 mm; ♀ 16 mm. Antennal pectinations: ♂ 14 ×, ♀ 7 × diameter of shaft.

The colour and strikingly distinct pattern of the wings are diagnostic.

DISTRIBUTION. Cameroun, Gabon, Zaire.

Holotype ♂, CAMEROUN: Efulen, 19.xi.1924 (*H. L. Weber*), in CM, Pittsburgh.

Paratypes. CAMEROUN: Efulen, 7.xi.1922 (*H. L. Weber*), 1 ♂; ibidem, 15.xi.1922, 1 ♂; ibidem, 17.xi.1922, 1 ♂, 1 ♀ (all CM, Pittsburgh). GABON: Belinga, Camp Central, 700 m, 22.iii.1963 (*G. Bernardi*), 1 ♀ (MBG, Paris); Franceville, 10.v.1963 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris). ZAIRE ('Belgian Congo'): Sankaru, Katako-Kombe, 17.xi.1951 (*Dr M. Fontaine*), 1 ♂ (MRAC, Tervuren).

*Zamarada saburra* sp. n.

(Text-fig. 260; Pl. 54, figs 668, 669; Pl. 110, fig. 992)

♂♀ (Pl. 110, fig. 992). Hyaline area of wings greyish yellow varyingly irrorate with brownish orange and finely edged distally with light brown then grey; discal spots ovate outlined in light brown, greyish yellow at centre. Non-hyaline terminal area light yellow (pl. 4, A4) irrorate with brownish orange (pl. 6, C6, caramel-brown) to reddish golden (pl. 6, C7); dentate subterminal fascia of similar shades, ill-defined except in apical area of fore wing, where dark irroration is usually less dense; cilia chequered light yellow and reddish golden. Underside of non-hyaline terminal area light yellow; fore wing suffused with light reddish brown, except at apex; hind wing narrowly light reddish brown proximally, remainder sparsely irrorate with the same shade; cilia as on upperside.

♂ genitalia (Text-fig. 260). Closely similar to those of *bastelbergeri*, differing in the shorter, smooth aedeagus, which lacks the apical thorn-like projection of that species, and in the form of the twin blades of the fulcrum, which are of equal length, each rounded at apex, and extend beyond the tip of the aedeagus.

♀ genitalia (Pl. 54, figs 668, 669). Corpus bursae wholly membranous; signum situate in posterior half.

Measurements. Fore wing: ♂ 16–18 mm; ♀ 15–16 mm. Antennal pectinations: ♂ 17 ×, ♀ 6 × diameter of shaft.

Reminiscent of *rubrifascia* Pinhey in the *metrioscaphes*-group, from which it may be distinguished externally by its larger size and the presence of a pale-centred, ovate discal spot on each fore wing; further, the distribution of the two species is not known to overlap.

DISTRIBUTION. Tanzania, Amani.

Holotype ♂, TANZANIA: Amani, i. 1963 (G. Pringle), Geometridae genitalia slide no. 7673, in BMNH.

Paratypes. TANZANIA: Usambara, Amani (G. Pringle), 1 ♂ (NMK, Nairobi), 1 ♀ (BMNH); ibidem, ii–iv. 1962, 2 ♂, 1 ♀ (NMK, Nairobi), 2 ♂, 2 ♀ (BMNH).

THE *CANDELABRA*-GROUP

Characterized in the male genitalia by the simple valve, broadly rounded at apex, by the form of its dorsal process, which from base to two-thirds is straight or sinuous, but with a short, spatulate, digitate projection at that point and which in its apical third is then arcuate; by the form of the fulcrum, which is asymmetrically dilate and coarsely spined at apex and by the ornamentation of the vesica, which may have one or two scobinate cornuti, one of which is transversely placed at one-third to one-half. The uncus is short, bluntly tipped and dorsally setose. Gnathus with ventral plate developed.

In the female genitalia the corpus bursae is narrowed posteriorly, sclerotized and scobinate. The lamella antevaginalis consists of a well developed, sclerotized plate, broadened basad.

Structurally appears to be without close relatives; placed next to the *vulpina*-group because of similarity of habitus.

Six species are recognized; three are only poorly represented and are not

described. *Z. prolata* sp. n. is tentatively associated with the *candelabra*-group because of the presence of a transverse, scobinate cornutus on the vesica and the form of the fulcrum.

#### KEY TO SPECIES AND SUBSPECIES

- 1 Apex of valve evenly rounded. Vesica with two scobinate cornuti. Apex of fulcrum asymmetrically dilate, apical margin coarsely spined . . . . . 2
- Valve tapered, apex of dorsal margin incurved towards uncus. Vesica with one transverse, scobinate cornutus at two-fifths. Apex of fulcrum asymmetrically dilate; a scobinate, rod-like projection, two-thirds as long as aedeagus, extends posteriorly from one side . . . . . *prolata* (p. 158)
- 2 (1) Basal two-thirds of dorsal process of valve straight and of even width. Apical twelfth of aedeagus slender and rod-like with rounded tip. Basal transverse cornutus one-half as long as width of aedeagus . . . . . *exigua* (p. 157)
- Basal two-thirds of dorsal process of valve sinuous and dilate. Apical sixth of aedeagus blade-like to tapered tip. Basal transverse cornutus arcuate, equal in length to width of aedeagus . . . . . 3
- 3 (2) Ratio of non-hyaline to hyaline areas at vein  $Cu_{1b}$  on fore wing 1 : 2. Distribution: Tanzania, Amani . . . . . *candelabra candelabra* (p. 156)
- Ratio of non-hyaline to hyaline areas at vein  $Cu_{1b}$  on fore wing 0.7 : 2. Distribution: Uganda . . . . . *candelabra flexura* (p. 157)

#### *Zamarada candelabra* sp. n.

(Text-figs 261, 262; Pl. 55, figs 670, 671; Pl. III, figs 994, 995)

♂ genitalia (Text-figs 261, 262). Gnathus with slender, scobinate ventral plate. Juxta narrowed medially. Valve simple, apex broadly rounded; basal two-thirds of dorsal process sinuous and dilate. Vesica with two cornuti.

♀ genitalia (Pl. 55, figs 670, 671). Posterior third of corpus bursae narrowed and sclerotized with a more strongly sclerotized, scobinate ridge.

Measurements. Fore wing: ♂ 12.5–13.0 mm; ♀ 13 mm. Antennal pectinations: ♂ 10 ×, ♀ 4 × diameter of shaft.

DISTRIBUTION. Tanzania, Uganda, Zaire.

Two subspecies are recognized, distinguished by the colour and pattern of the wings.

#### *Zamarada candelabra candelabra* subsp. n.

(Pl. III, fig. 994)

♂♀. Hyaline area of wings tinged with dull yellow (pl. 3, B3), lightly irrorate with brownish grey. Dentate subterminal fascia light yellow (pl. 4, A4) edged proximally with brownish orange (pl. 7, C7); non-hyaline terminal area of each wing brownish grey (pl. 11, D2) proximad of subterminal fascia, light orange (pl. 5, A5) irrorate with brownish grey distad of it; cilia chequered light orange and brownish grey. Ratio of non-hyaline to hyaline area at vein  $Cu_{1b}$  on fore wing 1 : 2. Underside of non-hyaline terminal area of wings brownish orange, apex and tornus of fore wing dark brown.

Externally similar to *bathyscaphes* and to *vulpina* and *longidens* in the *vulpina*-group. Distinguished from *bathyscaphes* by the underside of the non-hyaline

terminal area of the hind wing, which is not suffused with dark brown; distinguished from *vulpina* and from *longidens* by the evenly marked subterminal fascia, which is not broadened between the costa and vein  $M_1$  on the fore wing. Distinguished structurally from all three species by the form of the dorsal process of the valve and by the ornamentation of the vesica in the male genitalia and by the form of the corpus bursae and the pattern of its sclerotization in the female genitalia.

DISTRIBUTION. Tanzania, Amani.

Holotype ♂, TANZANIA: Amani, xii (*G. Pringle*), Geometridae genitalia slide no. 7338, in BMNH.

Paratypes. TANZANIA: Amani (*G. Pringle*), 1 ♂, 1 ♀ (BMNH); Amani xi. 1965 (*R. H. Carcasson*), 1 ♀ (NMK, Nairobi).

### *Zamarada candelabra flexura* subsp. n.

(Pl. III, figs 995)

Distinguished from the nominate subspecies by the smoother, less crenulate distal margin of the hyaline area and by the paler colour and the usually narrower non-hyaline terminal area of each wing; the intrusion of the hyaline into this area, between veins  $M_3$  and  $Cu_{1b}$ , is shallower and evenly rounded distally. The ratio of non-hyaline to hyaline areas is 0.7:2.

DISTRIBUTION. W. Uganda, E. Zaire.

Holotype ♂, UGANDA: Fort Portal, v. 1958 (*R. H. Carcasson*), Geometridae genitalia slide no. 7494, in BMNH.

Paratypes. UGANDA: holotype data, 2 ♀ (BMNH), 1 ♀ (NMK, Nairobi); Fort Portal, Mpanga Forest, ii. 1957 (*R. H. Carcasson*), 1 ♂ (BMNH); ibidem, v. 1958 (*R. H. Carcasson*), 1 ♂ (BMNH), 1 ♂, 1 ♀ (NMK, Nairobi); Toro, Kibale Forest, v. 1966 (*R. H. Carcasson*), 1 ♂, 1 ♀ (BMNH). ZAIRE ('Belgian Congo'): Kibali-Ituri, Nioka, 10.vii. 1953 (*J. Hecq*), 1 ♂ (MRAC, Tervuren).

### *Zamarada exigua* sp. n.

(Text-figs 263, 264; Pl. 55, figs 672, 673; Pl. III, fig. 996)

♂ ♀ (Pl. III, fig. 996). Hyaline area of wings tinged with green, finely edged distally with dark grey and sparsely striate with dark grey; discal spots grey. Non-hyaline terminal area of each wing light buff irrorate with light grey; subterminal fascia dark grey, dentate distad, diffuse proximad; cilia chequered light buff and grey. Underside of non-hyaline terminal area: fore wing grey, dark and intense anterior of vein  $M_3$  and at tornus; hind wing buff suffused with dark grey anterior of vein  $M_3$ .

♂ genitalia (Text-figs 263, 264). Ventral plate of gnathus narrowly rounded and minutely scobinate. Juxta slender and of even width. Valve similar to that of *candelabra*, but basal two-thirds of dorsal process slender, straight and of even width; projection at two-thirds longer than in that species. Apical twelfth of aedeagus slender and rod-like with rounded tip. Apical cornutus scobinate; basal transverse cornutus one-half as long as width of aedeagus.

♀ genitalia (Pl. 55, figs 672, 673). Posterior half of corpus bursae narrowed, posterior third sclerotized, more strongly than in *candelabra*. Lamella antevaginalis sclerotized, broadly rounded anteriorly, narrowed posteriorly.



Measurements. Fore wing: ♂ 13 mm, ♀ 12.0–13.5 mm. Antennal pectinations: ♂ 12 ×, ♀ 6 × diameter of shaft.

Externally distinct in the contrastingly patterned buff and grey non-hyaline terminal area of the upper surface of the wings. In the male genitalia the form of the dorsal process of the valve and of the aedeagus and in the female genitalia the form of the sterigma and pattern of the sclerotization of the corpus bursae are diagnostic.

DISTRIBUTION. W. Uganda, E. Zaire.

Holotype ♂, UGANDA: Kigezi, Kayonza, iii. 1967 (R. C. Otieno), Geometridae genitalia slide no. 7601, in BMNH.

Paratypes. UGANDA: holotype data, 1 ♂ (NMK, Nairobi); W. Ankole, Kalinzu Forest, iv. 1938 (T. H. E. Jackson), 1 ♂ (BMNH); Fort Portal, v. 1958 (R. H. Carcasson), 1 ♀ (BMNH), 1 ♀ (NMK, Nairobi); Fort Portal, Mpanga Forest, ii. 1957 (R. H. Carcasson), 1 ♀ (BMNH). ZAIRE ('Belgian Congo'): Kibali-Ituri, Nioka, 7.vii.1953 (J. Hecq), 1 ♀; ibidem, 28.vii.1953, 1 ♀; ibidem, 31.vii.1953, 1 ♀ (all MRAC, Tervuren).

### *Zamarada prolata* sp. n.

(Text-figs 265, 266; Pl. 56, figs 674, 675; Pl. III, fig. 997)

♂ ♀ (Pl. III, fig. 997). Hyaline area of wings tinged with green, sparsely striate with pale reddish grey and finely edged distally with buff and dark grey; discal spots dark grey. Costa of fore wing buff striate with reddish grey. Non-hyaline terminal area of wings reddish grey (pl. 8, B2) proximad of weakly marked and broken, brownish yellow subterminal fascia, pale greyish orange (a very pale pl. 5, B3) distad of it; cilia chequered light buff and grey. Underside of non-hyaline terminal area dark brown; cilia as on upperside.

♂ genitalia (Text-figs 265, 266). Juxta weakly developed, apical half tapered. Valve simple and tapered, apex of dorsal margin incurved towards uncus; dorsal surface of dorsal process shallowly excavate in middle third. Aedeagus with narrowly rounded apex and a short, digitate projection at three-fourths. Apex of fulcrum asymmetrically dilate; a scobinate, rod-like projection, two-thirds as long as aedeagus extends posteriorly from one side. Vesica with one transverse, scobinate cornutus at two-fifths.

♀ genitalia (Pl. 56, figs 674, 675). Posterior half of corpus bursae narrowed, posterior eighth sclerotized and minutely scobinate. Lamella antevaginalis similar in shape to that of *exigua*, but with a short, semicircular projection from anterior margin.

Measurements. Fore wing: ♂ ♀ 12–13 mm. Antennal pectinations: ♂ 9 ×, ♀ 5 × diameter of shaft.

Colour of non-hyaline terminal area intermediate between that of *candelabra flexura* and *exigua*; greyer than the former, and distinguished from the latter by the presence of reddish grey proximad of the brownish grey, rather than dark grey, subterminal fascia. Distinguished from *candelabra flexura* by the broader, shallower intrusions of hyaline into the patterned terminal area of each wing. In the male genitalia the form of the valve and of the aedeagus and in the female genitalia the form of the lamella antevaginalis with the short, semicircular projection from the anterior margin are diagnostic.

BIOLOGY. G. D. H. Carpenter found pupae on the foliage of *Crotalaria striata* DC (= *C. pallida* Aiton) (Leguminosae) in Uganda.

DISTRIBUTION. Malawi, Uganda, Burundi.

Holotype ♂, UGANDA: N.W. Victoria Nyanza, E. of Bugalla, Sesse Is., Lutoka, 0-25 ft, forest path, 13.x.1912 (*G. D. H. Carpenter*), in UM, Oxford.

Paratypes. UGANDA: holotype locality, emerged 10.i.1913 from pupa found on leaf of *Crotalaria striata* DC found on forest edge, lake shore, 1 ♀; ibidem, emerged 24.i.1913, 1 ♀ (both UM, Oxford); Ankole, Kalinzu Forest, xi. 1961 (*R. Carcasson*), 1 ♀; Toro, Kibale Forest, v. 1966 (*R. H. Carcasson*), 1 ♀; Toro, Bwamba, ix. 1961 (*N. Mitton*), 1 ♂ (all NMK, Nairobi); Fort Portal, Mpanga Forest, v. 1958 (*R. H. Carcasson*), 1 ♀ (BMNH). MALAWI: Zomba, 5.xi. (*J. Omer-Cooper*), 1 ♀; Zomba Plateau, ix. 1920 (*H. Barlow*), 1 ♂; Namtembo, near Zomba, iii. 1922 (*H. Barlow*), 1 ♂; S.W. of Lake Chilwa, 8.i.1914 (*S. A. Neave*), 1 ♀; Mt Mlanje, 17.iii.1913, 1 ♀; ibidem, 31.xii.1913, 1 ♂; Mlanje, Lunchenya R., 30.i.1914, 1 ♂ (all *S. A. Neave*) (BMNH).

The male of a pair of specimens from Burundi differs in having a broader, appreciably less tapered apex to the valve. These examples may represent a subspecies and have been excluded from the type-series.

BURUNDI: Kitega, m.v., vii. 1962 (*Dr M. Fontaine*), 1 ♂; ibidem, 18.vi.1966, 1 ♀ (both MRAC, Tervuren).

#### THE *IGNICOSTA*-GROUP

Characterized in the male genitalia by the form of the slender, bifurcate valve; by the presence of exceptionally long setae extending to the apex of the valve from the digitate projection near the base of its dorsal process; and by the short, but strongly sclerotized fulcrum, which does not extend to the apex of the aedeagus. The vesica is without a cornutus.

The male hind tibia is not dilate, but encloses a capsule of short, bristle-like hair scales.

#### KEY TO SUBSPECIES

- 1 Ventral arm of bifurcate valve longer than the dorsal. Apex of aedeagus tapered and simple. Distribution: eastern half of Africa . . . . . 2
- Arms of bifurcate valve equal in length. Apex of tapered aedeagus hook-like. Distribution: W. Africa and W. Uganda . . . . . *ignicosta hamulata* (p. 162)
- 2 (1) Non-hyaline terminal area of wings predominantly reddish grey. Distribution: S. W. Zambia and N. W. Rhodesia below 500 ft . . . . . *ignicosta ignicosta* (p. 160)
- Non-hyaline terminal area of wings predominantly a bright orange red. Distribution: Tanzania, Katanga, Zambia and Rhodesia above 500 ft, Mozambique, Angola . . . . . *ignicosta pyrilampes* (p. 160)

#### *Zamarada ignicosta* Prout

(Text-figs 267-270; Pl. 56, figs 676, 677; Pl. III, figs 998-1000; Map 4)

*Zamarada ignicosta* Prout, 1912 : 198.

♂ genitalia (Text-figs 267-270). Uncus tapered. Ventral plate of gnathus well developed,

smoothly sclerotized, scoop-like in shape. Valve slender and bifurcate, relative length of arms varying geographically; dorsal process with setose, digitate projection from near base, setae extending to or beyond apex of valve. Aedeagus tapered, apex simple or hook-like.

♀ genitalia (Pl. 56, figs 676, 677). Lamella postvaginalis produced posteriorly and narrowly rounded; posterior margin of lamella antevaginalis shallowly bilobate. Ductus bursae sclerotized and minutely scobinate in posterior half.

Measurements. Fore wing: ♂ 11.5–13.0 mm; ♀ 11.5–14.0 mm. Antennal pectinations: ♂ 10 ×, ♀ 3 × diameter of shaft.

Three subspecies are recognized, two distinguished by colour and wing pattern, each with similar genitalia, and a third is distinguished by the form of the valves and aedeagus in the male genitalia.

DISTRIBUTION (Map 4). Ivory Coast, Ghana, Cameroun, W. Uganda, Zaire, Tanzania, Mozambique, Malawi, Zambia, Rhodesia, Angola.

### *Zamarada ignicosta ignicosta* Prout

(Text-figs 269, 270; Pl. III, fig. 998; Map 4)

*Zamarada ignicosta* Prout, 1912 : 198. Holotype ♂, RHODESIA (BMNH) [examined].

♂ ♀ (Pl. III, fig. 998). Collar light yellow. Frons, head and basal half of dorsal surface of antenna reddish orange (pl. 7, B8) to brownish orange (pl. 7, C8, copper). Hyaline area of wings weakly tinged with green and striate with grey. Costa of fore wing light yellow irrorate with reddish orange. Non-hyaline terminal area of wings reddish grey (pl. 12, C2), sometimes irrorate with reddish orange, and slenderly edged both proximally and distally with reddish orange; dentate subterminal fascia light yellow edged proximally with reddish orange, except between veins  $R_4$  and  $R_5$  on fore wing, where it is edged with black. Underside of non-hyaline terminal area of wings greyish orange.

♂ genitalia (Text-figs 269, 270). Ventral arm of bifurcate valve longer than dorsal. Apex of aedeagus tapered and straight.

Measurements. Fore wing: ♂ 12–13 mm; ♀ 14 mm.

DISTRIBUTION (Map 4). S.W. Zambia and N.W. Rhodesia, below 500 ft.

#### MATERIAL EXAMINED.

*Zamarada ignicosta* Prout, holotype ♂, RHODESIA: Victoria Falls, 26.v.1911, Geometridae genitalia slide no. 5934, in BMNH.

RHODESIA: Half-way Wankie-Victoria Falls, vii. 1929 (*G. van Son*), 1 ♀ (BMNH).

ZAMBIA: Livingstone, 25–28.v.1954 (*A. J. T. Janse*), 1 ♂, 2 ♀ (TM, Pretoria), 1 ♀ (BMNH).

### *Zamarada ignicosta pyrilampes* Prout

(Pl. III, figs 999, 1000; Map 4)

*Zamarada ignicosta pyrilampes* Prout, 1915 : 345. LECTOTYPE ♂, ANGOLA (BMNH), here designated [examined].

*Zamarada hemimeres* Prout, 1915 : 342. Holotype ♂, MALAWI (BMNH) [examined]. **Syn. n.**

*Zamarada pyrocincta* Hampson ab. 1, Hampson, 1910 : 470.

*Zamarada pyrocincta* Hampson ab. *pyrocinctoides* Strand, 1917 : 10. LECTOTYPE ♂, ZAIRE (BMNH), here designated [examined]. **Syn. n.**

*Zamarada pyrilampes* Prout; Janse, 1932 : 143, pl. 10, fig. 4.

♂ ♀. Similar in structure to the nominate subspecies, but distinguished externally by the reduction or absence of grey striae on the hyaline area of the wings and by the brighter, orange-red colour (pl. 6, B7) of the non-hyaline terminal area (Pl. 111, fig. 999). In some examples the orange-red is more or less irrorate with reddish grey (pl. 12, C2).

Measurements. Fore wing: ♂ 11.5–13.0 mm; ♀ 13 mm.

*Zamarada hemimeres* Prout represents an aberration in which the subterminal fascia is broadly dark brown; the non-hyaline terminal area is reddish grey proximad of it and orange-red distad of it (Pl. 111, fig. 1000). Strict page priority has not therefore been followed and *pyrilampes* is retained for the name of the subspecies.

DISTRIBUTION (Map 4). S. Tanzania, Mozambique, Malawi, Rhodesia and Zambia above 500 ft, S.E. Zaire.

#### MATERIAL EXAMINED.

*Zamarada ignicosta pyrilampes* Prout, lectotype ♂, here designated, ANGOLA: Marimba, 30.ix.1903 (*Dr Ansorge*): '*Zamarada ignicosta pyrilampes* Prout ♂ type' [in Prout's hand-writing]: Geometridae genitalia slide no. 5932, in BMNH. *Zamarada hemimeres* Prout, holotype ♂, MALAWI ('Nysaland'): Mt Mlanje, 6.ii.1913 (*S. A. Neave*), Geometridae genitalia slide no. 5931, in BMNH. *Zamarada pyrocincta* Hampson ab. *pyrocinctoides* Strand, lectotype ♂ here designated, ZAIRE ('Belgian Congo'): 150–200 miles W. of Kambove, 3500–4500 ft, 1.xi.1907 (*Neave* Coll.), 1907–230: Geometridae genitalia slide no. 5933, in BMNH.

The lectotype and paralectotype of ab. *pyrocinctoides* are also paralectotypes of *Zamarada pyrocincta* Hampson; the two specimens were regarded by Hampson as aberrations of *pyrocincta*, but subsequently were found to be distinct from the lectotype and the remainder of the type-series of that species.

TANZANIA: Kilosa, 28.xii.1925 (*N. C. E. Miller*), 1 ♂ (BMNH); Nachingwea, iv. 1961 (*W. Bigger*), 3 ♂ (BMNH), 1 ♂, 1 ♀ (NMK, Nairobi). MOZAMBIQUE: Ruvo Valley, 1.iv.1913 (*S. A. Neave*), 1 ♂; ibidem, 2000 ft, 28.xi.1913, 1 ♂; Kola Valley, 7.iv.1913 (*S. A. Neave*), 1 ♀; E. end of Mt Chiperrone, 4.iv.1913 (*S. A. Neave*), 1 ♀ (all BMNH); Chiluvo Hills, 3.xi.1963, 1 ♂; Zambezia Prov., 16 miles S. of Vila Junqueiro, 1.v.1970 (*E. Pinhey*), 1 ♂, 1 ♀ (all NMR, Bulawayo). MALAWI: Mt Mlanje, i, ii, iii, xii (*S. A. Neave*), 11 ♂, 4 ♀; Mlanje, Luchanya R., i, ii, xii (*S. A. Neave*), 1 ♂, 1 ♀; Chiromo, 400 ft, 19.iv.1910 (*S. A. Neave*), 1 ♂ (all BMNH). RHODESIA: Vumba, 20–30.i.1965 (*B. D. Barnes*), 1 ♂ (TM, Pretoria); Vumba Mts, Umtali ii–iii. 1962, 1 ♂ (NMR, Bulawayo). ZAMBIA: Zambezi Rapids, Mwinilunga, 19–24.i.1965, 3 ♂ (NMR, Bulawayo); Lake Bangweulu dist., ix–xii. 1946 (*M. Steele*), 1 ♂ (BMNH). ZAIRE ('Belgian Congo'): 150–200 miles W. of Kambove, 3500–4500 ft, 2.xi.1907 (*Neave* coll.), 1 ♂ (*Zamarada pyrocincta* Hampson ab. *pyrocinctoides* Strand, paralectotype); Elisabethville, i, iii, v, ix–xii (*C. Seydel*), 7 ♂, 2 ♀ (MRAC, Tervuren); Lulua, Kafakumba, xii. 1930 (*Overlaert*), 1 ♂ (BMNH). ANGOLA: Fort Don Carlos, 22.ix.1903 (*Dr Ansorge*), 1 ♀; Marimba, 30.ix.1903 (*Dr Ansorge*), 2 ♂, 3 ♀ (*Zamarada ignicosta pyrilampes* Prout, paralectotypes, in BMNH).



*Zamarada ignicosta hamulata* subsp. n.

(Text-figs 267, 268; Map 4)

Externally closely similar to subsp. *pyrilampes*; distinguished in the male genitalia by the equal length of the arms of the bifurcate valve and by the hook-like apex of the aedeagus. The genitalia of the female appear to be identical with those of the nominate subspecies and of subsp. *pyrilampes*.

Measurements. Fore wing: ♂ 11.5 mm; ♀ 11.5–12.0 mm.

DISTRIBUTION (Map 4). Ivory Coast, Ghana, Cameroun, Uganda.

Holotype ♂, IVORY COAST: Lamto, 36 km N.N.W. of Tiassalé, 20–23.iv.1969 (*C. Herbulot*), in coll. Herbulot, Paris.

Paratypes. IVORY COAST: holotype data, 1 ♂, 2 ♀; Yapo-Sud, 22 km S.S.E. of Agboville, 12–18.iv.1969, 2 ♂, 2 ♀ (all *C. Herbulot*, in coll. Herbulot, Paris); Côte d'Ivoire, 1 ♂, 2 ♀ (BMNH). GHANA: Northern Territories, Kete-Krachi (*A. W. Cardinall*), 1 ♂ (BMNH). CAMEROUN: Plateau du Kounden, 4 km S.E. Centre Vétérin, 1410 m, 6–7.iv.1972, 2 ♀; Massif du Manengouba, Piste Bakwat-Mwakoumel, 1240 m, 11–12.iv.1972, 1 ♀; N'Kolbisson [7 km W. de Yaoundé], 700 m, 15–18.iv.1972, 2 ♂; 6 km N.E. d'Edea, 28–29.iii.1970, 1 ♀; 8 km N. d'Edea, 30.iii–1.iv.1970, 1 ♂, 3 ♀ (all *C. Herbulot*, in coll. Herbulot, Paris). UGANDA: Entebbe, iii. 1961 (*N. Mitton*), 1 ♂ (BMNH).

## THE SCINTILLANS-GROUP

The male genitalia are characterized by the form of the short uncus, the sides of which are produced in lobe-like form and extend either ventrally or posteriorly, and the dorsal surface of which is setose basad; by the form of the valves, each of which bears a dense, transverse tuft of long setae on the dorsal surface. Aedeagus slightly spiral in form. Fulcrum longer than aedeagus, arcuate and either scobinate or spined at apex. Vesica without cornutus.

In the male the hind tibia is dilate with a hair-pencil.

## KEY TO SPECIES

- |       |                                                                                                                                                                                                               |                             |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 1     | Apex of left valve rounded and smooth. Apex of fulcrum tapered and tipped with one or two stout spines . . . . .                                                                                              | <i>scintillans</i> (p. 162) |
| –     | Apex of left valve tapered and scobinate. Apex of fulcrum densely and finely scobinate or with serrate margin . . . . .                                                                                       | 2                           |
| 2 (1) | Base of dorsal margin of valve rounded; dorsal process grossly dilate and setose in basal half. Fulcrum dilate apicad with serrate margin . . . . .                                                           | <i>flavicaput</i> (p. 164)  |
| –     | Base of dorsal margin of valve with tapered, setose projection; dorsal process weakly dilate and setose in basal half. Fulcrum of even width to rounded apex, densely and minutely scobinate apicad . . . . . | <i>gracilata</i> (p. 166)   |

*Zamarada scintillans* Bastelberger

(Text-figs 271, 272; Pl. 58, figs 682, 683; Pl. III, figs 1001, 1002)

*Zamarada scintillans* Bastelberger, 1909 : 100. LECTOTYPE ♂, TANZANIA (NMS, Frankfurt), here designated [examined].

*Zamarada flavicincta* Hampson, 1910 : 471, pl. 39, fig. 4. LECTOTYPE ♂, ZAMBIA (BMNH), here designated [examined].

*Zamarada flavicincta* Hampson; Oberthür, 1912 : 259, 350, pl. 152, fig. 1464.

*Zamarada scintillans* Bastelberger; Janse, 1932 : 137, pl. 10, fig. 3 only; *not* pl. 2, fig. 13, text-fig. 38.

♂♀ (Pl. 111, figs 1001, 1002). Hyaline area of wings often tinged with greyish yellow, variably striate with grey and slenderly edged distally with yellow. Costa of fore wing yellow, lightly irrorate with grey and suffused with orange or reddish orange at base. Non-hyaline terminal area of wings orange (pl. 5, A7) to golden yellow (pl. 6, B7) variably irrorate with reddish grey (pl. 10, B2) and dark grey and finely edged proximally and distally with dark grey; subterminal fascia light yellow, dentate and usually very clearly defined; cilia chequered yellow and grey. Underside of non-hyaline terminal area variable, brown to grey, darker proximally; subterminal fascia buff and diffused.

♂ genitalia (Text-figs 271, 272). Ventral plate of gnathus triangular. Valves asymmetrical; apex of left valve rounded and smooth, that of right valve truncate; dorsal process dilate and setose in basal half. Fulcrum tapered and tipped with one or two stout spines.

♀ genitalia (Pl. 58, figs 682, 683). Sterigma asymmetrical, as illustrated.

Measurements. Fore wing: ♂ 10.5–14.5 mm; ♀ 11.0–13.5 mm. Antennal pectinations: ♂ 12 ×, ♀ 4 × diameter of shaft.

Externally a distinctive species; readily recognizable by the mainly orange-coloured non-hyaline terminal area of the wings; each has a sharply marked, yellow subterminal fascia and yellow and grey chequered cilia. In a few examples the orange is densely suffused with shades of grey, but the subterminal fascia and chequered cilia remain conspicuous. In the male genitalia the form of the dorsally setose and asymmetrical valves and of the spine-tipped fulcrum and in the female genitalia the form of the asymmetrical sterigma are diagnostic.

DISTRIBUTION. Kenya, Tanzania, Mozambique, Malawi, Rhodesia, Zambia, Zaire.

#### MATERIAL EXAMINED.

*Zamarada scintillans* Bastelberger, lectotype ♂ here designated, TANZANIA ('D. Ost Afrika'): Nyasaland, Kigonsera, Coll. Bastelberger, type no. 2710, in NMS, Frankfurt. *Zamarada flavicincta* Hampson, lectotype ♂, here designated, ZAMBIA ('N.E. Rhodesia'): E. Luangwa (Loangwa) Dist., 2400 ft, Petauke, 10.iii.1905 (S. A. Neave), pres. by him and B.S.A. Co., 1909–122: '*Zamarada flavicincta* Hmps. type ♂' [in Hampson's hand-writing]: Geometridae genitalia slide no. 6005, in BMNH.

KENYA: Nairobi, Thika Rd., vi. 1951 (E. Pinhey), 1 ♀. TANZANIA: Kigoma 25.v.1928 (C. H. B. Grant), 1 ♂; Itumba, 1 ♀ (all BMNH); Kigonsera, 1 ♂, 1 ♀ (BMNH), 5 ♂, 4 ♀ (ZSBS, Munich). MOZAMBIQUE: Ruvo Valley, 2000 ft, 15.xii.1913 (S. A. Neave), 1 ♂; 20 miles E. of Muanza, 25.viii.1971 (E. Pinhey), 1 ♀ (NMR, Bulawayo). MALAWI: Zomba Plateau, v–vii, xii (H. Barlow), 5 ♂; Luchenza, Magunda Estate (F. Nisbet), 1 ♂; Mt Mlanje, 26.i–17.ii.1914 (S. A. Neave), 3 ♂, 2 ♀ (all BMNH); Blantyre, 2.vii.1905 (H. Byatt), 1 ♀ (UM, Oxford). RHODESIA: Vumba Mts, Umtali, i. 1964, 1 ♂ (NMR, Bulawayo); Umtali, i–iii. 1951 (P. A.

*Sheppard*), 1 ♀; Salisbury, viii. 1900 (*G. A. K. Marshall*), 2 ♂ (*Zamarada flavicincta* Hampson, paralectotypes in BMNH); Salisbury, ii. 1956, 1 ♂; Marandellas, x. 1961, 1 ♂, 1 ♀ (all NMR, Bulawayo); Selukwe (*F. W. Short*), 2 ♂, 1 ♀; Gwelo, vi. 1918 (*O'Neil*), 1 ♂ (all BMNH). ZAMBIA: 8 miles N. of Livingstone, 25-28.v.1954 (*A. J. T. Janse*), 2 ♂, 1 ♀ (TM, Pretoria); Mwinilunga, ii. 1960, 2 ♂ (NMR, Bulawayo); N. Luangwa, Mt Ulungu, 3000 ft, 12.vi.1905 (*S. A. Neave*), 4 ♂ (*Zamarada flavicincta* Hampson, paralectotypes in UM, Oxford); E. Luangwa Dist., 3-3500 ft, Mbala country, 10.v.1905 (*S. A. Neave*), 1 ♂ (*Zamarada flavicincta* Hampson, paralectotype in UM, Oxford); L. Chambezi Valley, Kasuma distr., 3900 ft, 15.v.1908 (*S. A. Neave*), 1 ♂ (*Zamarada flavicincta* Hampson, paralectotype in UM, Oxford); Valley of Chambezi, 4000 ft, 19.v.1908 (*S. A. Neave*), 1 ♀ (*Zamarada flavicincta* Hampson, paralectotype in BMNH); Abercorn, v. 1964 (*D. Vesey-Fitzgerald*), 1 ♂ (NMK, Bulawayo). ZAIRE ('Belgian Congo'): Région de M'Pala (*R. P. Guillemé*), 1 ♂ (BMNH); Elisabethville, i. 1936 (*C. Seydel*), 1 ♂; ibidem, 13.ix.1950, 1 ♂ (all MRAC, Tervuren); Shinkolobwe (Chinkolobwe) (11°02' S. 26°35' E.), ii-iv, 3 ♂ (BMNH); ibidem (Tshinkolobwe), 18.vii.1930 (*J. Romieux*), 1 ♀ (MHN, Geneva).

### *Zamarada flavicaput* Warren

(Text-figs 273, 274; Pl. 57, figs 678, 679; Pl. III, figs 1003, 1004)

*Zamarada flavicaput* Warren, 1901 : 212. Holotype ♀, ANGOLA (BMNH) [examined].

*Zamarada pyrocincta* Hampson, 1910 : 470, pl. 39, fig. 5. LECTOTYPE ♂, ZAIRE (BMNH), here designated [examined]. **Syn. n.**

[*Zamarada flavicosta* Warren sensu Hampson, 1910 : 470. Misidentification.]

[*Zamarada flavicaput* Warren sensu Hampson, 1910 : 470 (part). Misidentification.]

♂♀ (Pl. III, figs 1003, 1004). Head and collar yellow. Costa of fore wing yellow, irrorate with grey. Hyaline area of wings tinged with yellow and slenderly edged distally with black. In the holotype of *flavicaput* the non-hyaline terminal area of the wings is almost uniformly orange-grey (pl. 6, B2), both on upper and under surfaces; on the upper surface the dentate subterminal fascia is faintly defined with light brown, but with black between veins  $R_4$  and  $R_5$  on the fore wing (Pl. III, fig. 1003).

In form *pyrocincta* Hampson the subterminal fascia is pale, slender and dentate, broadly edged distally with brownish orange (pl. 6, C8) to light brown (pl. 6, D8), but with black between veins  $R_4$  and  $R_5$  on the fore wing and often between  $R_5$  and  $M_3$  on the hind wing; the remainder of the non-hyaline terminal area is light brown varyingly suffused with reddish grey (pl. 10, B2) (Pl. III, fig. 1004). Underside of non-hyaline terminal area of wings uniformly brownish grey; proximal two-thirds of costa of fore wing yellow irrorate with grey.

♂ genitalia (Text-figs 273, 274). Ventral plate of gnathus well developed, tip of plate sometimes shallowly bifurcate. Valves asymmetrical, base of each dorsal margin rounded; dorsal process with a semi-circular, setose projection from basal half. Fulcrum dilate apicad with serrate margin.

♀ genitalia (Pl. 57, figs 678, 679). Lamella postvaginalis with medial process extending posteriorly. Lamella antevaginalis consisting of a strongly sclerotized plate broadly rounded posteriorly. Ductus bursae slender and tubular, two-thirds as long as corpus bursae, sclerotized at posterior margin with a short, digitate process at one side.

Measurements. Fore wing: ♂ 14.0-15.5 mm; ♀ 12-16 mm. Antennal pectinations: ♂ 10 ×. ♀ 3 × diameter of shaft.

Distinguished externally from similarly coloured *ignicosta* by its larger size and in the male by the presence of a dilate hind tibia with its tuft of long hair-scales. In the male genitalia the form of the asymmetrical valves, in the female the form of the sterigma and ductus bursae are diagnostic.

DISTRIBUTION. Tanzania, Mozambique, Malawi, Rhodesia, Zambia, Zaire, Angola.

#### MATERIAL EXAMINED.

*Zamarada flavicaput* Warren holotype ♀, ANGOLA: Luacinga R., xi. 1899 (*Prentice*), Geometridae genitalia slide no. 5948, in BMNH. *Zamarada pyrocincta* Hampson, lectotype ♂, here designated, ZAIRE ('Belgian Congo'): Katanga, Kambove, 4000–5000 ft, 22.iii.1907: '*Zamarada pyrocincta* Hampson type ♂' [in Hampson's hand-writing]: Geometridae genitalia slide no. 5937, in BMNH.

TANZANIA: Kigonsera, 1 ♂, 1 ♀ (MNHU, Berlin), 1 ♀ (BMNH). MOZAMBIQUE: Ruvo Valley, 1–10.v.1913 (*S. A. Neave*), 2 ♂, 2 ♀; E. of Mt Chipirone, 3–4.iv.1913 (*S. A. Neave*), 1 ♂, 2 ♀; Kola Valley, 8.iv.1913 (*S. A. Neave*), 1 ♂. MALAWI: Mt Mlanje, i, iii, iv (*S. A. Neave*), 4 ♀; Zomba Plateau, iv–v. 1920 (*H. Barlow*), 2 ♂, 1 ♀; Luchenza, Magunda Estate (*F. Nisbet*), 1 ♂ (all BMNH); Cholo, 2700 ft (*R. C. Wood*), 1 ♀ (CM, Pittsburgh). RHODESIA: Vumba Mts, Umtali, ii–iii. 1961, 1 ♂; Salisbury, 15.ix.1958 (*A. J. Duke*), 1 ♀ (both NMR, Bulawayo). ZAMBIA: Abercorn, i. 1956, 1 ♀ (NMR, Bulawayo); E. Luangwa Dist., Petauke, 2400 ft, xii. 1904–iii. 1905 (*S. A. Neave*), 1 ♂, 1 ♀ (BMNH), 11 ♂, 5 ♀ (UM, Oxford) (*Zamarada pyrocincta* Hampson, paralectotypes); Luangwa Valley, 12–20 miles W. of Petauke, 1700 ft, 7.viii.1905, 1 ♀; East Luangwa Distr., Mbala country, 3–3500 ft, v. 1905, 1 ♂, 1 ♀; Mouth of Chambezi to Mansya, 4500 ft, 26–28.x.1908, 2 ♀ (*Zamarada pyrocincta* Hampson, paralectotypes); Lower Chambezi Valley, Mpika district, 3900 ft, 20.v.1908, 1 ♂ (*Zamarada pyrocincta* Hampson, paralectotype); Lower Chambezi Valley, Kasama Dist., 3900 ft, 7.v.1908, 1 ♂ (*Zamarada pyrocincta* Hampson, paralectotype) (all *S. A. Neave*, in UM, Oxford); Fort Jameson to Lundazi, 4000 ft, 9.vi.1910 (*S. A. Neave*), 1 ♂; Fort Jameson (*A. A. Longshaw*), 1 ♂; Bwana Mkubwa, ix. 1929 (*Bell-Marley*), 1 ♀ (all BMNH); Ndola, Fatima School, 6.i.1964 (*E. Hausmann*), 1 ♀ (ZSBS, Munich); Solwezi, iii. 1960, 1 ♂; Mwinilunga, Zambezi Rapids, i. 1965, 2 ♂ (all NMR, Bulawayo); Nkana (12°50' S. 28°11' E.), ii. 1934 (*Mrs Prismall*), 1 ♀ (TM, Pretoria). ZAIRE ('Belgian Congo'): Région de M'pala (*R. P. Guilleme*), 2 ♂ (BMNH); Kabunda, xii. 1928 (*C. Seydel*), 1 ♂ (MRAC, Tervuren); Lualaba Valley, 1 ♂; Kikura R., Lifura Valley, 8.v.1919 (*T. A. Barns*), 1 ♂ (BMNH); Elisabethville, vi, viii–xi (*C. Seydel*), 4 ♀ (BMNH), 2 ♀ (ZSBS, Munich), 7 ♂, 11 ♀ (MRAC, Tervuren); Katanga, Kipopo (Elisabethville), x–xii. 1961 (*Don R. Maréchal*), 1 ♂ (MRAC, Tervuren); 18 miles S.W. Elisabethville (*Dr H. S. Evans*), 1 ♂ (BMNH); Lubumbashi, xi. 1926 (*C. Seydel*), 1 ♀ (TM, Pretoria). ANGOLA: Cubal R., ii–iv. 1899 (*Prentice*), 4 ♂; Bihé, Ceramba, iii. 1903 (*W. C. Bell*), 1 ♀; Bihé, Bingondo, 20–24.x.1904 (*Ansorge*), 1 ♂; Bihé, Gamba, xii. 1934 (*R. Braun*), 1 ♀; N. Bailundu, 1901 (*Pemberton*), 1 ♀ (all BMNH); Malange



District, Gauca, 20 miles E. of Rio Quanza, 3650 ft, 4.i.1931 (R. & L. Boulton), 1 ♂ (CM, Pittsburgh).

### *Zamarada gracilata* sp. n.

(Text-figs 275, 276; Pl. 57, figs 680, 681; Pl. III, fig. 1005)

♂♀ (Pl. III, fig. 1005). Externally closely similar to specimens of the darker, greyer nominate form of *flavicaput*, with which it occurs at Abercorn in Zambia. On average a little shorter in wing length; the non-hyaline terminal area of the wings is a darker shade of brown (pl. 6, E5-6, cocoa-brown) with the weakly defined, dentate subterminal fascia of a redder brown (pl. 7, E6-7).

In the female the antennal pectinations are a little longer than in *flavicaput*, being six times instead of three times as long as the diameter of the shaft.

♂ genitalia (Text-figs 275, 276). Uncus similar to that of *flavicaput*. Ventral plate of gnathus well developed, tip rounded. Valves asymmetrical, similar to those of *flavicaput* but with a short, setose projection at the base of each dorsal margin; dorsal process shorter and stouter than in *flavicaput* and lacking the semi-circular, setose dilation in basal half. The aedeagus differs from that of *flavicaput* in the finely tapered, not rounded apex and in the more slender and finely scobinate apical part of the fulcrum.

♀ genitalia (Pl. 57, figs 680, 681). Differ from *flavicaput* in the presence of a shallow, posteriorly rounded lamella antevaginalis and an appreciably shorter and broader ductus bursae, lacking a process at the posterior margin.

Measurements. Fore wing: ♂ 13.5 mm; ♀ 13.0-13.5 mm. Antennal pectinations: ♂ 11 ×, ♀ 6 × diameter of shaft.

DISTRIBUTION. Zambia, Angola.

Holotype ♂, ZAMBIA: Abercorn, i. 1966 (I.R.L.C.S.), Geometridae genitalia slide no. 7376, in BMNH.

Paratypes. ZAMBIA: Abercorn, i. 1966 (I.R.L.C.S.), 1 ♀ (BMNH); Abercorn, ii-iii. 1954 (*D. Vesey-Fitzgerald*), 1 ♂, 2 ♀ (NMK, Nairobi); Abercorn, 13.i.1963, 1 ♂; *ibidem*, ii. 1955, 1 ♂; xii. 1963, 1 ♀ (all NMR, Bulawayo).

A short series of eight specimens from Angola is tentatively associated with *gracilata*, but excluded from the type-series, because of minor modifications in the sclerotization of the posterior fourth of the corpus bursae in the female genitalia.

ANGOLA: Bihé (*Pemberton*), 1 ♂, 1 ♀; N. Bailundu, ix. 1901 (*Pemberton*), 6 ♀ (all BMNH).

### THE EUPHROSINE-GROUP

Similar to the *scintillans*-group in having asymmetrical valves and in the left valve having a dense, transverse band of long setae on the dorsal surface apicad. Uncus bell-shaped with a short, tapered, strongly sclerotized, beak-like tip and a pair of lateral membranous and setose lobes. Ventral plate of gnathus developed. Apical fourth of aedeagus with a semi-circular, blade-like projection. Fulcrum simple, one-half or less than one-half as long as aedeagus. Vesica with a cluster of short, slender spines. The male hind tibia is simple.

In the female genitalia the ductus seminalis is dilate and scobinate.

*Zamarada euphrosyne* Oberthür

(Text-figs 277, 278; Pl. 58, figs 684, 685; Pl. 112, fig. 1017)

*Zamarada euphrosyne* Oberthür, 1912 : 260, 350, pl. 152, figs 1467, 1468. LECTOTYPE

♂, CAMEROUN (BMNH), here designated [examined].

*Zamarada euphrosyne* Oberthür; Gaede, 1915 : 116.*Zamarada euphrosyne* Oberthür; Herbulot, 1954 : 326.

♂ ♀ (Pl. 112, fig. 1017). Hyaline area of wings tinged with greyish yellow and sparsely irrorate with reddish grey; discal spots dark grey. Basal and non-hyaline terminal areas of each wing reddish grey (pl. 12, D2) irrorate with black; dentate subterminal fascia light brown edged distally with black; cilia chequered reddish grey and greyish yellow, the greyish yellow extending proximad to reach hyaline area of each wing between veins  $M_3$  and  $Cu_{1b}$ . Underside of non-hyaline terminal area brownish grey; cilia chequered brownish grey and greyish yellow, the latter colour suffusing proximad as on upperside.

♂ genitalia (Text-figs 277, 278). Ventral plate of gnathus broad, minutely scobinate medially. Juxta very slender. Dorsal process of valve with setose projection at one-third. Aedeagus short and stout with an apically rounded, blade-like projection in apical fourth. Fulcrum broad and short, arising at one-half of aedeagus.

♀ genitalia (Pl. 58, figs 684, 685). Lamella postvaginalis tapered and narrowly rounded posteriorly. Basal part of ductus seminalis dilate, similar to that of *dilucida*, partially coiled and minutely scobinate.

Measurements. Fore wing: ♂ 9–11 mm; ♀ 8.5–11.0 mm. Antennal pectinations: ♂ 15 ×, ♀ 6 × diameter of shaft.

In pattern and colour, especially in the extension of the greyish yellow suffusion of the non-hyaline terminal area between veins  $M_3$  and  $Cu_{1b}$  on each wing, reminiscent of *aglae*; distinguished by its smaller size and appreciably longer antennal pectinations in both sexes. Structurally the form of the valves, with the transverse band of long setae on the dorsal surface of the left valve, and of the aedeagus with the short, broad fulcrum and the dense cluster of short, slender spines on the vesica in the male genitalia and the form of the sterigma and of the dilate and scobinate ductus seminalis in the female genitalia are diagnostic.

DISTRIBUTION. Equatorial Africa.

## MATERIAL EXAMINED.

*Zamarada euphrosyne* Oberthür, lectotype ♂, here designated, CAMEROUN ('Afriq. Occid.'): Johann-Albrechts Höhe, Station Kamerun, 1896 (*L. Conradt*): '*Zamarada euphrosyne* Obthr. ♂' (in Oberthür's hand-writing): black and white outline print of fig. 1467: Geometridae genitalia slide no. 1538, in BMNH.

GUINEA: Beyla (*Dr Mir. Mrázek*), 1 ♂, 3 ♀ (MM, Brno); Macenta, 2000 ft, v. 1926 (*C. L. Collenette*), 4 ♀; Soundedou, near Macenta, 1600 ft, 13.v.1926 (*C. L. Collenette*), 1 ♀ (all BMNH). LIBERIA: Nimba, Grassfield, vi–viii. 1967 (*A. Forbes-Watson*), 2 ♀ (NMK, Nairobi); Simbek, 15.v.1909 (*A. Pearse*), 1 ♀ (BMNH). SIERRA LEONE: Freetown, ix. 1949, 1 ♀; Bo, xi. 1967 (*R. Revell*), 1 ♀; ibidem, vii. 1969, 1 ♂, 6 ♀; Moyamba, iv. 1903 (*D. Cator*), 1 ♀ (all BMNH). IVORY COAST: Lamto, 36 km N.N.W. of Tiassalé, 20–23.iv.1969 (*C. Herbulot*), 3 ♂, 4 ♀; Yapo Sud, 22 km S.S.E.

of Agboville, 12-18.iv.1969 (*C. Herbulot*), 5 ♂, 19 ♀ (all coll. Herbulot, Paris); Bingerville, v-ix. 1915 (*G. Melou*), 6 ♂, 30 ♀; Man, 1200 ft, 26-30.vi.1926 (*C. L. Collenette*), 1 ♀. GHANA: Bolgatanga, iv. 1962 (*D. J. Lewis*), 1 ♂; Juaso, 14.i.1939 (*G. Cansdale*), 1 ♀; ibidem, 10.ii.1937, 1 ♂; Kete-Krachi (*A. W. Cardinall*), 1 ♀; Kumasi, i, ii, v (*Lt. Sanders*), 3 ♀; ibidem (*H. Whiteside*), 2 ♀; Takwa (*R. E. James*), 1 ♀; Manso, N.E. of Cape Coast, iii-iv. 1922 (*N. E. Bell*), 1 ♂, 2 ♀; Somahu, 18.i.1919 (*G. Harrisson*), 1 ♀; A'Koon, ii, iii, vi (*G. Harrisson*), 3 ♂; Aburi, xi. 1901 (*W. H. Johnson*), 1 ♀. NIGERIA: Zungeru, 7.xi.1910 (*Scott Macfie*), 1 ♀; Niger, Degama (*Dr Ansorge*), 1 ♂; Old Calabar, 2 ♀ (all BMNH); Old Calabar, 150 ft, ii. 1961 (*C. J. Gordon*), 1 ♀ (UM, Oxford); Calabar, ii. 1961, (*G. Markham*), 1 ♂ (NMK, Nairobi). CAMEROUN: holotype locality, 2 ♂, 1 ♀ (*Zamarada euphrosyne* Oberthür paralectotypes); near Banyo, 3000 ft, viii. 1921, 1 ♂; Bitje, Ja River, 1 ♀ (all BMNH); Efulen, 4.ii.1915 (*A. I. Good*), 1 ♂ (CM, Pittsburgh). ANGOLA: Amboim District, Fazenda Congulu, 7-800 m, iv. 1934 (*Dr K. Jordan*), 9 ♂, 13 ♀; Quirimbo, 75 km E. of P. Amboim, 300 m, 7-12.v.1934 (*Dr K. Jordan*), 1 ♀; Quiculungo, 120 km N. of Lucala, 800 m, iv. 1936 (*R. Braun*), 1 ♂. ZAIRE ('Belgian Congo'): Upper Uele distr., iv, 1 ♂ (all BMNH); N. Lac Kivu, iv. 1948 (*Mme J. V. Leroy*), 1 ♀ (MRAC, Tervuren). UGANDA: Toro, Kibale Forest, v. 1966 (*R. H. Carcasson*), 1 ♂ (BMNH); Masaka, Sango Bay, Katera, x. 1960, 1 ♀; Jinja, Mabira Forest, x. 1962 (both *R. H. Carcasson*, in NMK, Nairobi); Entebbe, vi. 1961, 1 ♀; Entebbe, Zika Forest, vi. 1961, 1 ♀ (both NMK, Nairobi). KENYA: N. Kavirondo, Maramas Dist., Ilala, 4500 ft, 21.v.1911 (*S. A. Neave*), 1 ♂. TANZANIA: Amani (*G. Pringle*), 3 ♂, 2 ♀ (all BMNH); E. Usambara, Amani, iii. 1950 (*E. Pinhey*), 1 ♂; ibidem, xi. 1965 (*R. H. Carcasson*), 2 ♂ (all NMK, Nairobi); Minaki, 9.i.1965, 1 ♀. MALAWI: Mt Mlanje, iii, v, x (*S. A. Neave*), 4 ♂, 2 ♀; Matope, 14.iv.1899 (*E. M. de Jersey*), 1 ♂ (all BMNH).

#### THE *RUFILINEARIA*-GROUP

Characterized externally in both sexes by the brightly marked orange-red and dark grey non-hyaline terminal area of the wings.

In the male genitalia both uncus and ventral plate of gnathus are asymmetrical. Uncus with a pair of large lateral, membranous and setose lobes; apex of uncus strongly sclerotized and rounded dorsally; ventral surface of apex with lobe or ridge inclined to the right. Ventral plate of gnathus strongly sclerotized, tip rounded and inclined to right side. Valves symmetrical. Aedeagus with tapered, blade-like projection from apical fourth. Fulcrum broad and short, shorter than one-half length of aedeagus. Vesica without cornutus.

The male hind tibia is simple.

In the female genitalia the sterigma and ductus bursae are strongly sclerotized.

The sole included species, *rufilinearia* Swinhoe, is apparently without any close relative in the genus; placed near *euphrosyne* because of similarity of uncus with its lateral, setose lobes and similarity of fulcrum.

*Zamarada rufilinearia* Swinhoe

(Text-figs 279, 280; Pl. 68, figs 724, 725; Pl. 112, fig. 1014)

*Zamarada rufilinearia* Swinhoe, 1904 : 516. LECTOTYPE ♂, TANZANIA (BMNH), here designated [examined].*Zamarada rufilinearia* Swinhoe; Hampson, 1910 : 469.*Zamarada calliope* Oberthür, 1912 : 259, 351, pl. 153, fig. 1469. LECTOTYPE ♀, TANZANIA (BMNH), here designated [examined].*Zamarada calliope* Oberthür; Gaede, 1915 : 116 [synonymy].

♂ ♀ (Pl. 112, fig. 1014). Hyaline area of wings greyish yellow (pl. 4, B5-6); costal area of fore wing suffused with orange-red (pl. 8, B8) and irrorate with dark grey (pl. 8, F1); discal spots absent. Basal area of fore wing and non-hyaline terminal area of each wing dark grey; lunulate subterminal fascia black, bordered distally with orange-red, finely on fore wing, broadly on hind wing. Underside of non-hyaline terminal area uniformly dark grey.

♂ genitalia (Text-figs 279, 280). Valves symmetrical, apices sclerotized, incurved towards uncus and scoop-like; dorsal process with setose projection at one-third.

♀ genitalia (Pl. 68, figs 724, 725). Sterigma strongly sclerotized; posterior margin of lamella postvaginalis narrowly cleft medially and fused anteriorly with short ductus bursae and with transverse band of lamella antevaginalis. Ductus seminalis dilate and membranous.

Measurements. Fore wing: ♂ 11-15 mm; ♀ 11-16 mm. Antennal pectinations: ♂ 19 ×, ♀ 4-5 × diameter of shaft.

Externally unmistakable, the striking colour of the wing pattern being diagnostic.

DISTRIBUTION. Uganda, Kenya, Tanzania, Zaire, Zambia, Malawi, Mozambique.

## MATERIAL EXAMINED.

*Zamarada rufilinearia* Swinhoe, lectotype ♂ here designated, TANZANIA ('Ost Afrika'): Dar-es-Salaam: 99-285 [purchased from Fruhstorfer]: '*Zamarada rufilinearia* Swinh. type ♂' [in Swinhoe's hand-writing]: Geometridae genitalia slide no. 5941, in BMNH. *Zamarada calliope* Oberthür, lectotype ♀ here designated, TANZANIA: Zanguebar, Mhonda Ouzigoua (*A. Hacquard* Mis. ap.), 1879, 1<sup>er</sup> Trim. 1880: black and white outline print of fig. 1469: '*Zamarada calliope* Obthr. ♀' [in Oberthür's hand-writing]: Ex Oberthür Coll. Brit. Mus. 1927-3, in BMNH.

UGANDA: Bwamba, vi. 1956 (*R. H. Carcasson*), 1 ♀ (NMK, Nairobi); Entebbe Zika Forest, vii. 1961, 1 ♀ (NMR, Bulawayo); Zika, 5.vi. 1961 (*W. K. Brown*), 1 ♂ (BMNH). KENYA: Mombasa (*van Someren*), 1 ♂. TANZANIA: Dar-es-Salaam, 1 ♀ (*Zamarada rufilinearia* Swinhoe paralectotype); Amani, iv. 1963 (*G. Pringle*), 1 ♂; Usangu Dist., Ft Kifulufulu Mtn, 3000 ft, 16.xii.1910 (*S. A. Neave*), 1 ♂; Turiani, v. 1949 (*T. H. E. Jackson*), 1 ♂ (all BMNH); W. Prov., L. Tanganyika, Ikola, ii. 1954 (*T. H. E. Jackson*), 1 ♂ (NMK, Nairobi). ZAIRE ('Belgian Congo'): Tanganyika [Province], Region de M'Pala (*R. P. Guillemé*), 1 ♂ (*Zamarada calliope* Oberthür, paralectotype). ZAMBIA: Between Luangwa R. and Petauke, 15.ix.1910, 1 ♂ (both BMNH); East Luangwa Dist., Mterize R., 40 miles S. of Petauke, 2500 ft, 23.iv.1905, 2 ♂ (UM, Oxford); ibidem, 2.xi.1904, 1 ♂ (BMNH); Luangwa Val., Niamadzi R., 2000 ft, 2.vii.1905, 1 ♂ (UM, Oxford) (all *S. A. Neave*); Ilonga, ii. 1966 (*I. Robertson*), 1 ♂ (NMK, Nairobi). MALAWI: Karonga Dist., Valley of N. Rukuru, 2-400 ft, 11.vii.1910, 1 ♂; S.W. of Lake Chilwa, 8.i.1914, 14 ♂, 8 ♀;



Ruo Valley, 24.x.1913, 2 ♂ (all BMNH); Mlanji Boma, 2400 ft, 27.iv-3.v.1910, 7 ♂, 4 ♀ (BMNH), 1 ♂, 1 ♀ (UM, Oxford); Mt Mlanje, 27.iii-16.iv.1913, 4 ♂, 3 ♀; between Mlanji and Zomba, 2-300 ft, 3.v.1910, 1 ♀ (all BMNH); Blantyre, c. 3000 ft, 17.iv.1910, 1 ♂ (UM, Oxford) (all *S. A. Neave*); Luchonza, 30 miles from Blantyre (*N. Nisbet*), 2 ♀; Magunda Estate, Luchenza (*F. Nisbet*), 2 ♂, 2 ♀; Namtembo, near Zomba, iii. 1922 (*H. Barlow*), 2 ♂, 2 ♀; Zomba, vii-viii. 1925 (*H. Barlow*), 1 ♂ (all BMNH); Nkata Bay, 7.ix.1960, 1 ♂ (NMR, Bulawayo). MOZAMBIQUE: Kola Valley, 8.iv.1913 (*S. A. Neave*), 1 ♀ (BMNH).

### THE *KOMPSOTES*-GROUP

Characterized in the male genitalia by the very slender valve, the basal three-fourths of which is not broader than the slender, simple rod-like dorsal process; apical fourth dilate, dorsal surface spined. Fulcrum digitate, one-fourth as long as aedeagus, apex rounded. Vesica without cornutus. The hind tibia is simple.

#### *Zamarada kompsotes* sp. n

(Text-figs 281, 282; Pl. 112, fig. 1016)

♂ (Pl. 112, fig. 1016). Hyaline area of each wing yellowish green, irrorate with cinnamon along posterior margin; distal margin of hyaline area shallowly lunulate, slightly excurved on fore wing, almost straight on hind wing, finely dark grey then silvery grey; costa of fore wing densely cinnamon; no discal spot; discocellulars, radius, cubitus and cubital veins on fore wing appear grey, due to greyish brown scales on underside. Non-hyaline terminal area light brown (pl. 6, D6, cinnamon-brown); dentate subterminal fascia very faintly defined in a slightly more orange-brown and edged distally with buff. Underside of non-hyaline terminal area of both wings, and discocellulars, radius, cubitus and cubital veins of fore wing greyish brown.

♂ genitalia (Text-figs 281, 282). Uncus short and tapered; dorsal surface setose. Ventral plate of gnathus minutely scobinate.

♀ not known.

Measurements. Fore wing: 9.0-9.5 mm. Antennal pectinations: ♂ 10 × diameter of shaft.

Externally distinct in both colour and pattern; structurally distinct in the slender form of the valve and of the short, digitate fulcrum.

DISTRIBUTION. Zaire, Gabon.

Holotype ♂, GABON: Makokou, Colline Mission biologique, 14.xi.1967 (*G. Bernardi*), in MBG, Paris.

Paratype. ZAIRE ('Belgian Congo'): Kasai, Dima, 15.i.1906 (*Waelbroeck*), 1 ♂ (MRAC, Tervuren).

### THE *FESSA*-GROUP

A group of mainly grey-coloured moths resembling large examples of *latilimbata* in the *minimaria*-group or *ascaphes* in the *pulverosa*-group, but having discal dots, not ringed spots.

Characterized in the male genitalia by the presence on each valve of longitudinal, sclerotized ridges on the ventral surface in the apical fourth and a dense tuft of long, deciduous hair-scales on the dorsal surface, near the apex of the dorsal margin; dorsal process with a large, setose projection in basal third; by the sclerotized and minutely but densely scobinate fultura superior; by the form of the tapered and slightly spiral aedeagus and the long, sinuous fulcrum, spined or serrate at tip. The uncus is stout, tapered and dorsally setose; arms of gnathus slender, tapered and joined by membrane only; vesica without cornutus. The male hind tibia is strongly dilate with a hair pencil.

Characterized in the female genitalia by the presence on the sterigma of a pair of broad, ovate, lateral lobes; the lamella postvaginalis has a small but strongly sclerotized, posteriorly bilobate medial process; the signum extends across the greater part of the width of the corpus bursae.

Six described species are included in the group; two further species are represented in the BMNH, but the material available for study is inadequate for description.

# KEY TO SPECIES

- 1 Non-hyaline terminal area of wings unusually narrow; ratio of non-hyaline to hyaline areas at costa of fore wing varies from 1 : 4 to 1 : 5 . . . . . 2
- Non-hyaline terminal area of wings normal; ratio of non-hyaline to hyaline areas at costa of fore wing varies from 1 : 3 to 1 : 2 . . . . . 3
- 2 (1) Hyaline area of wings sparsely striate with grey; subterminal fascia brownish orange. Scobinate fultura superior broader than width of dorsal process of valve at mid-length (ratio 5 : 4) . . . . . *denticatella* (p. 171)
- Hyaline area of wings densely striate with grey; non-hyaline terminal area almost uniformly grey, subterminal fascia weakly defined in darker shade. Scobinate fultura superior equal or subequal in width to width of dorsal process of valve at mid-length (ratio varies from 4 : 4 to 3 : 4) . . . . . *densisparsa* (p. 172)
- 3 (1) Proximal half of non-hyaline terminal area of wings intensely black (Known only from unique ♀ type) . . . . . *eroessa* (p. 174)
- Wings not so patterned . . . . . 4
- 4 (3) Acicular tip of ventral margin of valve extending to or just beyond level of boldly rounded, dorsally setose apex of dorsal margin. . . . . *euterpina* (p. 174)
- Valve not so formed . . . . . 5
- 5 (4) Longitudinal ridge, parallel with sclerotized ventral margin of valve, extending basad along mid-valve from one-half dorsal margin; acicular apical projection from midway between the two (Text-fig. 290) . . . . . *dorsiplaga* (p. 175)
- Longitudinal ridge, parallel with sclerotized ventral margin of valve, extending basad along mid-valve from three-fourths dorsal margin; acicular apical projection from near apex of longitudinal ridge (Text-fig. 286) . . . . . *fessa* (p. 173)

## *Zamarada denticatella* Prout

(Text-figs 283, 284; Pl. 59, figs 686, 687; Pl. 112, fig. 1006)

*Zamarada denticatella* Prout, 1922 : 180. Holotype ♂ RHODESIA (TM, Pretoria) [examined].

*Zamarada denticatella* Prout; Janse, 1932 : 136, pl. 2, fig. 1, text-fig. 38.

♂♀ (Pl. 112, fig. 1006). Hyaline area of wings lightly striate with grey; distal margin very finely edged with black, except in costal area of fore wing; discal spots small and black. Costa of fore wing light buff (nearest pl. 4, A2, yellowish white) striate with grey. Dentate subterminal fascia brownish orange (pl. 6, C3) broken into interneural, toothed markings; non-hyaline terminal area of each wing reddish grey (pl. 11, B2) proximad of subterminal fascia, light buff irrorate with black distad of it. Non-hyaline area unusually narrow; ratio of non-hyaline to hyaline areas at costa of fore wing 1 : 4 to 1 : 5. Underside of non-hyaline terminal area uniformly greyish brown (pl. 7, E3).

♂ genitalia (Text-figs 283, 284). Apex of valve diagonally truncate; short, sclerotized ridges extend basad from apical margin, between acicular tip at dorsal side and smaller, thorn-like projection at ventral side. Ratio of width of sclerotized and scobinate fultura superior to width of dorsal process at mid-length is 5 : 4.

♀ genitalia (Pl. 59, figs 686, 687).

Measurements. Fore wing: ♂ 10–13 mm; ♀ 13.5 mm. Antennal pectinations: ♂ 9 ×, ♀ 3 × diameter of shaft.

A distinctively patterned species readily recognizable by the well contrasted dark proximal and light buff distal halves of the narrow, non-hyaline terminal area of each wing.

DISTRIBUTION. Tanzania, Malawi, Zambia, Rhodesia, Zaire, Angola.

#### MATERIAL EXAMINED.

*Zamarada denticatella* Prout, holotype ♂, RHODESIA: Salisbury, 29.xi.1917 (O'Neil), type no. 2225, genitalia slide no. G1404, in TM, Pretoria.

TANZANIA: 40 miles S. of Iringa, 10.iii.1950 (N. Mitton), 1 ♂ (TM, Pretoria); Kigonsera, 1 ♂ (MNHU, Berlin). MALAWI: Zomba, Domasi, xii. 1919 (H. Barlow), 1 ♂ (BMNH). ZAMBIA: East Luangwa Dist., Petauke, 2400 ft, iii. 1905 (S. A. Neave), 1 ♂ (UM, Oxford), 1 ♂ (BMNH). RHODESIA: Marandellas, i, 1 ♂, 2 ♀ (NMR, Bulawayo); Salisbury, iii, xii (O'Neil), 1 ♂, 1 ♀ (BMNH); ibidem, ii. 1950 (N. Mitton), 1 ♂ (NMK, Nairobi), 1 ♂ (NMR, Bulawayo); Salisbury Expt. Stn, i, x, xii, 3 ♂ (NMR, Bulawayo). ZAIRE ('Belgian Congo'): Katanga, Kolwezi, vii. 1964 (V. Allard), 1 ♂ (NMK, Nairobi); Elisabethville, ix, x (C. Seydel), 1 ♂ (MRAC, Tervuren), 1 ♂, 1 ♀ (BMNH). ANGOLA: Bihé, Bigondo, 20–24.x.1904 (Dr Ansorge), 2 ♂ (BMNH).

#### *Zamarada densisparsa* Prout

(Text-fig. 285; Pl. 59, figs 688, 689; Pl. 112, fig. 1007)

*Zamarada densisparsa* Prout, 1922a : 363. Holotype ♂, RHODESIA (BMNH) [examined].

*Zamarada densisparsa* Prout; Janse, 1932 : 136, pl. 1, fig. 27.

♂♀ (Pl. 112, fig. 1007). Hyaline area of wings tinged with dull yellow (pl. 3, B3) and striate with yellowish grey (pl. 3, B2); discal spots yellowish grey. Costa of fore wing and terminal area of each wing yellowish grey irrorate with dull yellow; subterminal fascia faintly indicated in a darker shade of grey. Underside of non-hyaline terminal area uniformly brownish grey.

♂ genitalia (Text-fig. 285). Closely similar to those of *denticatella*, apparently differing only in the narrower sclerotized and scobinate area of the fultura superior; ratio of width of this area to width of dorsal process of valve at mid-length varies from 4 : 4 to 3 : 4.

♀ genitalia (Pl. 59, figs 688, 689). Apparently identical with those of *denticatella*.

Measurements. Fore wing: ♂ 13–14 mm; ♀ 15 mm. Antennal pectinations: ♂ 10 ×, ♀ 4 × diameter of shaft.

Distinguished from the closely related *denticatella* by the denser grey striation of the hyaline area of the wings and its smoother, less crenulate distal margin and by the uniformly grey non-hyaline terminal area. Distinguished further in the male by the more slender sclerotized and scobinate fultura superior and in the female by the rather longer antennal pectinations.

DISTRIBUTION. Rhodesia.

#### MATERIAL EXAMINED.

*Zamarada densisparsa* Prout, holotype ♂, RHODESIA: Salisbury, 24.vii.1918 (J. O'Neil), Geometridae genitalia slide no. 5911, in BMNH.

RHODESIA: Salisbury, vi, vii (J. O'Neil), 3 ♂, 2 ♀ (BMNH).

### *Zamarada fessa* Prout

(Text-figs 286, 287; Pl. 60, figs 690, 691; Pl. 112, figs 1009, 1010)

*Zamarada fessa* Prout, 1912 : 199. Holotype ♀, RHODESIA (BMNH) [examined].

♂♀ (Pl. 112, figs 1009, 1010). Hyaline area of wings lightly irrorate with grey and slenderly edged distally with dark grey to black; discal spots dark grey. Costa of fore wing usually tinged with brownish orange and irrorate with grey. Non-hyaline terminal area orange-grey (pl. 5, B2) to brownish grey (pl. 5, C2, birch-grey), usually uniformly coloured; little trace of a subterminal fascia in the female, but sometimes with a well defined brownish orange (pl. 5, C6), dentate subterminal fascia present in the male, the fascia in some examples sharply and slenderly edged distally with dark grey or black, except in discal area. Underside of non-hyaline terminal area uniformly greyish brown (pl. 5, D3).

♂ genitalia (Text-figs 286, 287). Longitudinal ridge, parallel with sclerotized and coarsely scobinate ventral margin of valve, extends basad along mid-valve from three-fourths dorsal margin; acicular apical projection from near apex of longitudinal ridge.

♀ genitalia (Pl. 60, figs 690, 691).

Measurements. Fore wing: ♂ 11.5–15.0 mm; ♀ 12.5–16.0 mm. Antennal pectinations: ♂ 15 ×, ♀ 3 × diameter of shaft.

Specimens of the *fessa*-group in which the non-hyaline terminal area of each wing is uniformly brownish orange or in which the costa of the fore wing and the subterminal fascia of each wing are well defined with brownish orange may be safely determined as *fessa*. In the male the form and position of the sclerotized ridges on the ventral surface of the valve are diagnostic; in the female genitalia the form of the sterigma serves to distinguish *fessa* from the closely similar *euterpina*, known only from Tanzania, but not from *eroessa* or *dorsiplaga*, which for the present can be determined only by wing pattern and association with known males.

DISTRIBUTION. Rhodesia.



## MATERIAL EXAMINED.

*Zamarada fessa* Prout, holotype ♀, RHODESIA: Selukwe, 20-27.x.1911 (*F. W. Short*), Geometridae genitalia slide no. 5915, in BMNH.

RHODESIA: Selukwe, i-v, vii-viii, x-xii (*F. W. Short*), 13 ♂, 9 ♀ (including 3 ♂, 4 ♀ *Zamarada fessa* paratypes) (BMNH); Khami, near Bulawayo, xi. 1956, 1 ♂ (NMR, Bulawayo), 1 ♀ (BMNH); Marandellas, x. 1961, 1 ♂ (NMR, Bulawayo); Vumba Mts, Umtali, x-xi, 1 ♂, 1 ♀ (NMK, Nairobi), 1 ♂ (NMR, Bulawayo), 1 ♂ (BMNH); 25 miles S. of Umtali, 14.ii.1950 (*N. Mitton*), 1 ♀ (TM, Pretoria); Lundi, 2-5.iii.1964 (*Vári & van Son*), 1 ♂ (BMNH).

*Zamarada eroessa* Prout

(Pl. 60, figs 692, 693; Pl. 112, fig. 1008)

*Zamarada eroessa* Prout, 1915 : 344. Holotype ♀, RHODESIA (BMNH) [examined].

*Zamarada eroessa* Prout; Janse, 1932 : 135, pl. 1, fig. 25.

♀ (Pl. 112, fig. 1008). Hyaline area of wings lightly irrorate with grey; discal spots grey mixed with black. Costa of fore wing brownish grey irrorate with black; an ill-defined spot opposite discal spot. Basal area of fore wing and non-hyaline terminal area of each wing pale grey, patterned as illustrated with black. Underside of non-hyaline terminal area greyish brown, darker proximally.

Measurements. Fore wing: ♀ 13.5 mm. Antennal pectinations: ♀ 3 × diameter of shaft.

The female holotype is similar in structure to *fessa*, with which it was taken by F. W. Short at Selukwe in Rhodesia and of which it may prove to be an aberration. As there exist two further species, undescribed because of inadequate material, the original specific status of *eroessa* has been retained.

The female illustrated by Janse under the name *eroessa* may prove to be a well marked specimen of *dorsiplaga*.

DISTRIBUTION. Rhodesia.

## MATERIAL EXAMINED.

*Zamarada eroessa* Prout, holotype ♀, RHODESIA: Selukwe, ii. 1913 (*F. W. Short*), Geometridae genitalia slide no. 5913, in BMNH.

*Zamarada euterpina* Oberthür sp. rev.

(Text-figs 288, 289; Pl. 61, figs 694, 695; Pl. 112, fig. 1011)

*Zamarada euterpina* Oberthür, 1912 : 258, 350, pl. 152, fig. 1458. Holotype ♂, ZAIRE (BMNH) [examined].

♂ genitalia (Text-figs 288, 289). Acicular tip of ventral margin of valve extends to, or a little beyond level of boldly rounded, dorsally setose apex of dorsal margin; a slender sclerotized ridge is situate medially on ventral surface of apical fourth.

♀ genitalia (Pl. 61, figs 694, 695). Differ from those of *fessa* in the smaller lateral lobes of the sterigma.

Measurements. Fore wing: ♂ ♀ 12–13 mm. Antennal pectinations: ♂ 15 ×, ♀ 4 × diameter of shaft.

Externally (Pl. 112, fig. 1011) closely similar to *fessa*. Antennal pectinations slightly longer in the female, but this character may prove inconstant when further material is available for study. In the male genitalia the form of the valve with the boldly rounded and dorsally setose apex of the dorsal margin, extending posteriorly almost to the level of the acicular apex of the ventral margin, is diagnostic.

DISTRIBUTION. Tanzania, Zaire.

#### MATERIAL EXAMINED.

*Zamarada euterpina* Oberthür, holotype ♂, ZAIRE: Tanganyika [W. shore of lake], region M'Pala (R. P. Guilleme), Geometridae genitalia slide no. 5918, in BMNH.

TANZANIA: Kilosa, 16.i.1922 (Loveridge), 1 ♂ (BMNH); Ilonga, Morogoro, i–iii. 1965 (Mrs Chalmers), 1 ♂ (NMK, Nairobi); Lindi, Ndanda, 300 m, 1–3.xii.1958 (Ch. Lindemann), 1 ♂, 1 ♀ (ZSBS, Munich). ZAIRE ('Belgian Congo'): Katanga, Shinkolobwe, 1.iv.1931, 1 ♂ (BMNH).

### *Zamarada dorsiplaga* Prout

(Text-figs 290, 291; Pl. 61, figs 696, 697; Pl. 112, fig. 1012)

*Zamarada dorsiplaga* Prout, 1922a : 362. Holotype ♀, RHODESIA (BMNH) [examined].

[*Zamarada fessa* Prout sensu Janse, 1932 : 135, pl. 1, fig. 29, text-fig. 39. Misidentification.]

♂ ♀ (Pl. 112, fig. 1012). Externally closely similar to *fessa* and to *euterpina*, with which latter species it occurs in Katanga; hyaline area of wings usually more densely irrorate with dark grey to black; costa of fore wing light buff to light grey irrorate with dark grey to black; dentate subterminal fascia often heavily marked with dark grey to black, rarely tinged with brownish orange. Distinguished in the male by the shorter antennal pectinations.

♂ genitalia (Text-figs 290, 291). Distinguished from closely similar *fessa* by the form of the valve; the series of longitudinal, sclerotized ridges on the ventral surface in the apical fourth extend for more than one-half of the distance from the ventral to the dorsal margins, with a strongly sclerotized ridge situate medially; the dorsal process is more slender and more finely tapered than in *fessa*.

♀ genitalia (Pl. 61, figs 696, 697). Appears closely similar to those of *fessa*, but distinguished from *euterpina* by the form of the lobes on the sterigma.

Measurements. Fore wing: ♂ 12.5–15.0 mm; ♀ 12.5–16.0 mm. Antennal pectinations: ♂ 12 ×, ♀ 4 × diameter of shaft.

DISTRIBUTION. Rhodesia, Zambia, Zaire.

#### MATERIAL EXAMINED.

*Zamarada dorsiplaga* Prout, holotype ♀, RHODESIA: Salisbury, 1.viii.1918 (J. O'Neil), Geometridae genitalia slide no. 7466, in BMNH.

RHODESIA: Salisbury, v, vii, x (J. O'Neil), 4 ♂, 1 ♀ (BMNH); Salisbury, iii, x, 1 ♂ (BMNH), 2 ♂ (NMR, Bulawayo); Shamva, xii. 1920 (J. O'Neil), 1 ♂ (BMNH);

N. Melsetter, Black Mt Inn, 10.xi.1965, 1 ♀ (BMNH). ZAMBIA: Abercorn, xi. 1963 (*D. Vesey-Fitzgerald*), 2 ♂ (NMK, Nairobi); Abercorn, i. 1956, 1 ♂ (BMNH), xii. 1963, 1 ♂ (NMR, Bulawayo). ZAIRE ('Belgian Congo'): Katanga, Shinkolobwe, 1.iv.1931, 1 ♂ (BMNH); Elisabethville, i, vii, x, xi (*C. Seydel*), 1 ♀ (MRAC, Tervuren), 2 ♂, 2 ♀ (BMNH); ibidem, 1.ii.1956, 1 ♂ (ZSBS, Munich).

### THE METRIOSCAPHES-GROUP

Characterized in the male genitalia by the sinuous form of the scobinate apex of the fulcrum and by the form of the tapered, blade-like aedeagus, usually bearing one or more digitate or tapered projections, and in the male hind tibia by the presence of a capsule-like pocket of hair-scales, equal in length to the width of the tibia. In the female genitalia the posterior margin of the lamella antevaginalis is scobinate or serrate and excavate medially.

Further, in the male genitalia the uncus is short, tapered and dorsally setose basad, the ventral plate of the gnathus well developed and minutely scobinate, the juxta slender and the vesica without cornutus.

Three of the fourteen included species differ in some respects from the above diagnosis in the male; *plana* has a simple, tapered aedeagus and an almost straight fulcrum, but agrees in leg-structure; *fumosa* differs in leg-structure by having the hind tibia dilate, enclosing a dense tuft of long hair-scales; *rubrifascia*, tentatively associated with the group, has a simple aedeagus, straight fulcrum and simple hind tibia. All three species accord well in the form of the lamella antevaginalis in the female genitalia.

### KEY TO SPECIES AND SUBSPECIES

- |       |                                                                                                                                                                                               |                                   |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 1     | Aedeagus simple, without projection . . . . .                                                                                                                                                 | 2                                 |
| —     | Aedeagus with one or two projections at about one-half . . . . .                                                                                                                              | 5                                 |
| 2 (1) | Valve tapered, dorsal margin straight or shallowly concave . . . . .                                                                                                                          | 3                                 |
| —     | Valve truncate, dorsal margin deeply concave at two-thirds <i>phrontisaria</i> (p. 190)                                                                                                       |                                   |
| 3 (2) | Apical fourth of ventral margin of valve coarsely spined . . . . .                                                                                                                            | <i>rubrifascia</i> (p. 182)       |
| —     | Dorsal and ventral margins of valve smooth . . . . .                                                                                                                                          | 4                                 |
| 4 (3) | Non-hyaline terminal area of each wing uniformly brownish orange; dentate subterminal fascia only weakly defined (Pl. 113, fig. 1026) <i>plana plana</i> (p. 183)                             |                                   |
| —     | Non-hyaline terminal area of each wing brownish grey; dentate subterminal fascia strongly defined (Pl. 113, fig. 1025) . . . . .                                                              | <i>plana denticincta</i> (p. 184) |
| 5 (1) | Setose projection at one-fourth dorsal process of valve triangular or trapezoid, anterior side extending almost to base of process . . . . .                                                  | 6                                 |
| —     | Setose projection at one-fourth dorsal process of valve slender and digitate . . . . .                                                                                                        | 8                                 |
| 6 (5) | Apical third of valve abruptly narrowed with longitudinal, scobinate ridge extending to apex. Projection at one-half aedeagus tapered and blade-like, longer than width of aedeagus . . . . . | <i>glareosa</i> (p. 180)          |
| —     | Valve evenly tapered. Projection at two-thirds aedeagus spatulate and digitate . . . . .                                                                                                      | 7                                 |
| 7 (6) | Apex of valve narrowly rounded; apical area smoothly sclerotized. Tip of uncus with minute projection inclined ventrad . . . . .                                                              | <i>seydeli</i> (p. 179)           |
| —     | Apex of valve tipped with short spine; apical area minutely but densely scobinate. Tip of uncus beak-like, produced ventrad <i>metrioscaphes</i> (p. 177)                                     |                                   |

- 8 (5) Aedeagus with one projection at one-half to two-thirds. Medial third of dorsal margin of valve deeply excavate . . . . . 9
- Aedeagus with two projections at about one-half, both rounded at apex, or one rounded and one thorn-like. Valve not so formed . . . . . 10
- 9 (8) Aedeagus dilate at two-thirds, with a diagonally transverse, semi-circular, blade-like projection. Apex of valve diagonally truncate, apical margin one-half as wide as greatest width of aedeagus . . . . . *geitaina* (p. 189)
- Aedeagus dilate at one-half with weakly developed, digitate projection at right side. Apex of valve truncate, apical margin equal in width to greatest width of aedeagus . . . . . *phrontisaria* (p. 190)
- 10 (8) Aedeagus with two projections at about one-half, one rounded, one thorn-like . . . . . 11
- Aedeagus with two projections at about one-half, both rounded at apex . . . . . 12
- 11 (10) Thorn-like projection equal in length to width of fulcrum. Apex of valve truncate . . . . . *varii* (p. 185)
- Thorn-like projection minute, one-fourth as long as width of fulcrum. Apex of valve narrowly rounded and incurved towards uncus; a short, thorn-like projection from mid apical area . . . . . *euerces* (p. 188)
- 12 (10) Apex of valve broadly and evenly rounded . . . . . *astyphela* (p. 186)
- Apex of valve not so formed . . . . . 13
- 13 (12) Apex of fulcrum symmetrical . . . . . 14
- Apex of fulcrum asymmetrical, with scobinate projection at left side. . . . . 15
- 14 (13) Valve abruptly narrowed at one-half dorsal margin, then strongly sclerotized to truncate apex. Postmedial fascia on each wing, forming distal margin of hyaline area, straight . . . . . *cathetus* (p. 192)
- Apex of valve shallowly bifurcate, apices of ventral and dorsal margins produced and tapered. Postmedial fascia on each wing, forming distal margin of hyaline area, excised between veins  $M_3$  and  $Cu_{1b}$  . . . . . *fumosa* (p. 191)
- 15 (13) Valve abruptly narrowed at one-half dorsal margin, then strongly sclerotized; apex smooth, sharply tapered and inclined towards uncus. Wings with patterned, non-hyaline terminal area excised between veins  $M_3$  and  $Cu_{1b}$  . . . . . *griseola* (p. 187)
- Valve evenly tapered to diagonally truncate apex; apical third of dorsal margin minutely serrate, tip acutely angled. Wings thinly scaled, uniformly buff irrorate with grey from base to termen . . . . . *unisona* (p. 193)

### *Zamarada metrioscaphes* Prout

(Text-figs 292, 293; Pl. 62, figs 698, 699; Pl. 113, figs 1018, 1019)

*Zamarada metrioscaphes* Prout, 1912 : 199. LECTOTYPE ♂ RHODESIA (BMNH), here designated [examined].

♂ ♀ (Pl. 113, figs 1018, 1019). Hyaline area of wings tinged with green, varyingly striate with brown to reddish grey and slenderly edged distally with black; discal spots dark grey; costa of fore wing straw-yellow, striate with dark grey. Non-hyaline terminal area reddish grey (pl. 12, B2); dentate subterminal fascia dark brown mixed with black, strongly marked between costa and vein  $M_3$  and between vein  $Cu_{1b}$  and posterior margin of each wing. Underside of non-hyaline terminal area greyish orange; apical area of fore wing densely suffused with greyish brown, the suffusion fading posteriorly in lightly marked specimens, extending to tornus in more heavily marked specimens; proximal half of hind wing suffused with greyish brown in anterior half of wing only.

In a series of over thirty specimens from Rhodesia and Mozambique the non-hyaline terminal area is a darker shade than in the type and the dentate subterminal fascia is heavily marked in black (Pl. 113, fig. 1019).



In a series of ten specimens from Kigonsera in S. W. Tanzania which resembles the female of *seydeli* (Pl. 113, fig. 1021), the non-hyaline terminal area is greyish orange (pl. 5, B3) irrorate with a very pale reddish grey; the subterminal fascia is weakly indicated with sparse brown scaling. In this form the underside of the non-hyaline terminal area is weakly marked greyish orange without dark suffusion.

Forms similar to the type and to the pale Kigonsera series together with intermediate forms are represented from Elisabethville.

♂ genitalia (Text-figs 292, 293). Tip of uncus beak-like and produced ventrad. Ventral plate of gnathus shallow, semi-circular and scobinate. Dorsal margin of valve sclerotized, apical area scobinate and tipped with a short spine; dorsal process with broad, setose projection in basal third. Apical fifth of aedeagus slender and tapered; a small, digitate projection from four-fifths. Apex of fulcrum finely tapered and extending beyond tip of aedeagus, apical area scobinate.

♀ genitalia (Pl. 62, figs 698, 699). Posterior margin of lamella antevaginalis curved, minutely serrate and incised medially, the depth of the incision varying individually; posterior margin of lamella postvaginalis crenulate with a strongly sclerotized U-shaped incision medially.

Measurements. Fore wing: ♂ 11.0–13.5 mm; ♀ 10–15 mm. Antennal pectinations: ♂ 9 ×, ♀ 3 × diameter of shaft.

Well marked examples are readily identified by colour and pattern; weakly marked examples may be distinguished from similarly coloured *glareosa* Bastelberger by the deeper intrusion of the hyaline area into the patterned terminal third of each wing and by the smaller discal spots. In the male genitalia the form of the valve with its spine-tipped, scobinate, apical area and the form of the aedeagus and in the female genitalia the form of the sterigma are diagnostic.

DISTRIBUTION. Eastern Africa, Kenya to Natal; Angola.

#### MATERIAL EXAMINED.

*Zamarada metrioscaphes* Prout, lectotype ♂ here designated, RHODESIA: Selukwe, xi. 1911 (*F. W. Short*): '*Zamarada metrioscaphes* Prout, type, Ent. xlv. 199' [in Prout's hand-writing]: without abdomen, in BMNH.

KENYA: Mombasa (*van Someren*), 2 ♂; Mombasa, Tiwi, iv. 1954 (*Capt. Croft*), 1 ♂ (NMK, Nairobi); Nyali, xi–xii (*D. G. Sevastopulo*), 2 ♂; Port Victoria, 10.vii.1949 (*H. B. D. Kettlewell*), 1 ♀ (all BMNH). UGANDA: Toro, Kibale Forest, v. 1966 (*R. H. Carcasson*), 1 ♂; Kigezi, Mafuga Rain Forest, 7500–8000 ft (*T. H. E. Jackson*), 2 ♂ (all NMK, Nairobi). TANZANIA: Nachingwea, iv. 1961 (*W. Bigger*), 1 ♂; Kigonsera, 5 ♂, 1 ♀ (ZSBS, Munich), 1 ♂, 1 ♀ (BMNH). BURUNDI: Upper Akanjuru Valley, viii. 1919 (*T. A. Barns*), 1 ♂ (BMNH); Kitega, 14.vii.1966 (*Dr M. Fontaine*), 1 ♂; ibidem, ix. 1963, 2 ♀ (all MRAC, Tervuren). ZAIRE ('Belgian Congo'): Elisabethville, i, iii, iv, vii, ix–xii (*C. Seydel*), 6 ♂, 3 ♀ (BMNH), 8 ♂, 7 ♀ (MRAC, Tervuren), 1 ♂, 2 ♀ (ZSBS, Munich); Kipopo (E'ville), x–xii. 1961 (*Don R. Maréchal*), 1 ♂, 1 ♀; Lubumbashi, xi. 1926 (*C. Seydel*), 1 ♀ (all MRAC, Tervuren); Lubudi, ii. 1960, 1 ♂ (NMR, Bulawayo). MALAWI: Blantyre (*J. E. S. Old*), 1 ♀ (*Zamarada metrioscaphes* Prout, paralectotype); Lower Shire Valley, near Chikawa, 600 ft, 12.iv.1910 (*S. A. Neave*), 1 ♂ (*Zamarada metrioscaphes* Prout, paralectotype, without abdomen); Mt Mlanje, i, ii, iv. 1913 (*S. A. Neave*), 1 ♂, 2 ♀; Luchenza,

Magunda Estate (*F. Nisbet*), 1 ♀. MOZAMBIQUE: Ruvo Valley, iv. 1913 (*S. A. Neave*), 1 ♂, 1 ♀ (BMNH); 48 miles S.E. of Inhaminga, 18.viii.1971 (*E. Pinhey*), 1 ♀; Zambezia Prov., 78 miles N.W. of Quelimane, 3.v.1970 (*E. Pinhey*), 1 ♂, 3 ♀; Panga Panga Forest, Inhamitanga, 31.x.1963, 1 ♂, 1 ♀; Dondo Forest, Dondo, x-xi (*E. Pinhey*), 1 ♂, 5 ♀ (all NMR, Bulawayo); Xiluvo, Vila Machado Dist., 9-10.iii.1964 (*Vári & van Son*), 1 ♀ (TM, Pretoria). ZAMBIA: Mwengwa, 22.x.1913 (*H. C. Dollman*), 1 ♀; Mwengwa, Mopani, 13.viii.1913 (*H. C. Dollman*), 1 ♂ (both BMNH); Abercorn, i-iii, xi, xii, 5 ♂, 2 ♀ (NMR, Bulawayo); Mid Chambezi Valley, Chinsali Distr., 4000 ft, 24.iv.1908 (*S. A. Neave*), 1 ♂; East Luangwa Dist., Petauke, 2000 ft, 9.iii.1905 (*S. A. Neave*), 1 ♂ (both UM, Oxford); Mpika District, 4000 ft, iii-iv. 1921, 1 ♂ (BMNH); Ndola, 10.i.1965, 2 ♂ (NMR, Bulawayo); Broken Hill, 24.ii.1950 (*N. Mitton*), 1 ♀ (TM, Pretoria); ibidem, 8.xi.1920 (*R. J. Gardner*), 1 ♂ (BMNH); Lusaka, 10.i.1956 (*R. C. Dening*), 1 ♂ (BMNH); Zambezi Rapids, Mwinilunga, i, ii, v, x, 4 ♂, 1 ♀ (NMR, Bulawayo). RHODESIA: Horseshoe Block, Sipolilo, 7.ix.1964 (*Mackworth-Praed*), 1 ♀ (BMNH); Vumba, 10.xii.1958 (*B. D. Barnes*), 1 ♂; Salisbury, 29-30.vii.1918, 2 ♀; ibidem, 25.iv.1966 (*A. J. Duke*), 1 ♂ (all NMR, Bulawayo); Sinoia, 22.ii.1950 (*N. Mitton*), 4 ♂ (TM, Pretoria); Gatooma, i, v, 2 ♂ (NMR, Bulawayo); Selukwe, xi. 1911, 1 ♀ (*Zamarada metrioscaphes* Prout, paralectotype); ibidem, vii-viii, 1 ♀; Melsetter, Mountain Inn, xi. 1950 (*H. B. D. Kettlewell*), 1 ♂ (all BMNH); Lundi, 13-16.iii.1961 (*Vári & van Son*), 16 ♂, 3 ♀; Van Niekerk Hotel, near Gwaai Bridge, 28-29.iv.1954 (*A. J. T. Janse*), 3 ♂, 1 ♀ (all TM, Pretoria). NATAL: Lebombo Mts, Jozini Dam, 9-14.i.1955 (*L. Vári*), 1 ♂ (TM, Pretoria). ANGOLA: Longa R., xi. 1899 (*Penrice*), 1 ♂ (BMNH); Lunda District, Cucumbi, 1250 m, ii. 1960 (*E. Mercier*), 1 ♀ (ZSBS, Munich); Mt Moco, Luimbale, 1800-1900 m, 15-18.iii.1934 (*Dr K. Jordan*), 6 ♂ (BMNH).

### *Zamarada seydeli* sp. n.

(Text-figs 294, 295; Pl. 62, figs 700, 701; Pl. 113, figs 1020, 1021)

[*Zamarada metrioscaphes* Prout sensu Janse, 1932: 138, pl. 1, fig. 33, text-fig. 39A. Misidentification.]

♂ ♀ (Pl. 113, figs 1020, 1021). Hyaline area of wings tinged with yellow, varying striate with light grey and slenderly edged distally with black; discal spots grey; costa of fore wing light yellow striate with grey. Non-hyaline terminal area greyish yellow (pl. 4, B3-4) suffused with reddish grey (pl. 8, B2) proximad of the greyish orange (pl. 6, B6), dentate subterminal fascia and irrorate with reddish grey and black distad of it; subterminal fascia often very strongly marked in discal area of hind wing; cilia pale yellow. In some examples the light yellow ground colour of the non-hyaline terminal area is obscured by dense reddish grey suffusion and the cilia in these examples are chequered yellow and grey. Underside of non-hyaline terminal area greyish brown; cilia as on upperside.

♂ genitalia (Text-figs 294, 295). Differs from closely related *metrioscaphes* in the shorter uncus, the slender, narrow scobinate ventral plate of the gnathus and in the form of the valve, which is sclerotized in the apical third, but not scobinate, the apex narrowly rounded; blunt, broad-based, setose projection from basal third of dorsal process appreciably smaller than that of *metrioscaphes*. Apex of fulcrum more coarsely spined than that of *metrioscaphes*.

♀ genitalia (Pl. 62, figs 700, 701). Distinguished from *metrioscaphes* by the broader, more boldly rounded lamella antevaginalis, which has a deeper, broader medial incision in the

posterior margin; the posterior margin of the lamella postvaginalis is membranous, the strongly sclerotized, medial U-shaped incision, so conspicuous in *metrioscaphes*, is absent from *seydeli*.

Measurements. Fore wing: ♂ 13.0–14.5 mm; ♀ 12–14 mm. Antennal pectinations: ♂ 13 ×, ♀ 4 × diameter of shaft.

DISTRIBUTION. Tanzania, Zaire, Burundi, Malawi, Mozambique, Zambia, Rhodesia, Angola.

Holotype ♂, ZAIRE ('Belgian Congo'): Elisabethville, iii. 1935 (C. Seydel), in MRAC, Tervuren.

Paratypes. TANZANIA: Mufindi (P. Burdon), 1 ♂; Iringa, iii. 1950 (N. Mitton), 1 ♂ (both NMK, Nairobi); Iringa, 10.iii.1950 (N. Mitton), 1 ♂, 1 ♀ (TM, Pretoria); Kigonsera, 1 ♂, 1 ♀ (ZSBS, Munich). ZAIRE ('Belgian Congo'): Elisabethville, i, iii, v, vi, xi, xii (C. Seydel), 1 ♂, 2 ♀ (MRAC, Tervuren), 2 ♂, 2 ♀ (BMNH), 1 ♂, 1 ♀ (ZSBS, Munich). BURUNDI: Kitega, 3.ix.1962 (Dr M. Fontaine), 1 ♀ (MRAC, Tervuren). MALAWI: Mlanje, 22.v.1913, 1 ♀; Luchenza, Magunda Estate (F. Nisbet), 2 ♂, 1 ♀; Luchonza, 30 miles from Blantyre (N. Nisbet), 1 ♂, 1 ♀; Zomba Plateau, vii. 1920 (H. Barlow), 1 ♂; ibidem, x. 1919, 1 ♀; Zomba, iv. 1920 (H. Barlow), 1 ♀. MOZAMBIQUE: Kola Valley, 8.iv.1913 (S. A. Neave), 1 ♂. ZAMBIA: Bwana Mkubwa (Bell-Marley), 2 ♀ (BMNH); Mwinilunga, ii. 1960, 1 ♂ (NMR, Bulawayo); Mwinilunga, Zambezi Rapids, 24.i.1966, 1 ♀. RHODESIA: Umtali District, 26.ii.1933 (P. A. Sheppard), 1 ♂; Vumba, 9.ii.1958 (B. D. Barnes), 1 ♂; ibidem, 3.ix.1967, 1 ♀ (all NMR, Bulawayo); Salisbury, 17–19.ii.1950 (N. Mitton), 1 ♂ (TM, Pretoria); ibidem, 20.ii.1950, 1 ♂ (NMK, Nairobi); Selukwe, viii. 1913 (F. W. Short), 1 ♀; Zimbabwe Plains, 10.vii.1949 (H. B. D. Kettlewell), 1 ♀ (both BMNH). ANGOLA: Malange District, Gauca, 20 miles E. of Rio Quanza, 3650 ft, i. 1931 (R. & L. Boulton), 1 ♀ (CM, Pittsburgh); Libollo (Pemberton), 1 ♀ (BMNH).

### *Zamarada glareosa* Bastelberger

(Text-figs 296, 297; Pl. 63, figs 702, 703; Pl. 113, figs 1022, 1023)

*Zamarada glareosa* Bastelberger, 1909 (31. vii) : 100. LECTOTYPE ♂, TANZANIA (NMS, Frankfurt), here designated [examined].

*Zamarada taborae* Strand, 1909 (15. ix) : 108. Holotype ♀, TANZANIA (MNHU, Berlin) [examined]. **Syn. n.**

*Zamarada nebulimargo* Prout, 1912 : 197. Holotype ♂, RHODESIA (BMNH) [examined].

*Zamarada euterpe* Oberthür, 1912 : 258, 350, pl. 152, fig. 1457. LECTOTYPE ♂, ZAIRE (BMNH), here designated [examined].

*Zamarada glareosa* Bastelberger; Gaede, 1915 : 115.

*Zamarada glareosa* Bastelberger; Janse, 1932 : 136, pl. 1, fig. 30, text-fig. 39.

♂♀ (Pl. 113, figs 1022, 1023). Hyaline area of wings irrorate with greyish orange (pl. 5, B4); discal spots ovate, greyish orange distinctly outlined in a darker shade; non-hyaline terminal area greyish orange irrorate with brownish orange, more densely proximad of the weakly marked and broken, dentate, brownish orange subterminal fascia. Underside of non-hyaline subterminal area uniformly pale brownish orange.

The typical form, matched by the type-specimens of both synonyms *euterpe* and *taborae*, is well figured in colour by Oberthür under the name *euterpe*.

There is some variation in the degree and shade of irroration of both the hyaline and non-hyaline areas of the wings; in a few examples, ten in about 150, it is light brown (pl. 5, D4); in a similar number the subterminal fascia and the discal spots are diffused and dark grey (Pl. 113, fig. 1023); the latter form was described by Prout as *nebulimargo*.

♂ genitalia (Text-figs 296, 297). Apical third of uncus of even width, tip blunt. Ventral plate of gnathus scobinate, tip narrowly rounded. A strongly sclerotized and coarsely scobinate ridge extends diagonally across the apical third of the valve, from base of dorsal margin to apex of ventral margin, tip acicular; dorsal process with a broad-based, triangular, setose projection in basal third. Aedeagus finely tapered with a tapered, blade-like projection at one-half. Apex of fulcrum dilate and coarsely spined apicad.

♀ genitalia (Pl. 63, figs 702, 703). Posterior margin of lamella antevaginalis serrate and medially cleft; posterior margin of lamella postvaginalis bilobate with sclerotized, concentric semicircular ridges medially.

Measurements. Fore wing: ♂ 13–17 mm; ♀ 14–19 mm. Antennal pectinations: ♂ 14 ×, ♀ little longer than the diameter of the shaft.

Despite variation in colour and pattern, *glareosa* may be distinguished from the similarly coloured nominate subspecies of *plana* Bastelberger by the presence of an ovate discal spot in the hyaline area of each wing. In the male genitalia the form of the valve and of the aedeagus with the tapered, blade-like projection and in the female genitalia the form of the sterigma are diagnostic.

DISTRIBUTION. Tanzania, Burundi, Malawi, Mozambique, Zambia, Rhodesia, Natal, Angola.

#### MATERIAL EXAMINED.

*Zamarada glareosa* Bastelberger, lectotype ♂ here designated, TANZANIA ('D. Ost Africa'): Nyasaland, Kigonsera: Coll. Bastelberger: 'Paratypoid', in NMS, Frankfurt. *Zamarada taborae* Strand, holotype ♀, TANZANIA ('D. Ost Afrika'): Tabora (*Trefurth*), in MNHU, Berlin. *Zamarada nebulimargo* Prout, holotype ♂, RHODESIA: Selukwe, x. 1911 (*F. W. Short*), Geometridae genitalia slide no. 6424, in BMNH. *Zamarada euterpe* Oberthür, lectotype ♂ here designated, ZAIRE ('Belgian Congo'): Tanganyika [Province], Region de M'Pala (*R. P. Guilleme*): '*Zamarada Euterpe* ♂ Obthr' [in Oberthür's hand-writing]: black and white outline of fig. 1457: Geometridae genitalia slide no. 6422, in BMNH.

TANZANIA: E. Usambara Mts, Amani, xii. 1956 (*B. Verdcourt*), 1 ♂; Dodoma, iii. 1950 (*N. Mitton*), 1 ♂; Ilonga, Morogoro, i–ii. 1965 (*Mrs Chalmers*), 1 ♂ (all NMK, Nairobi); 40 miles S. of Iringa, iii. 1950, 1 ♂, 1 ♀ (BMNH), 6 ♂, 4 ♀ (TM, Pretoria); Iringa-Kilosa Valley, iv. 1954 (*E. Pinhey*), 1 ♀ (BMNH); Kigonsera, 1 ♂ (BMNH), 12 ♂, 2 ♀ (ZSBS, Munich). BURUNDI: Kitega, vii (*Dr M. Fontaine*), 1 ♂, 2 ♀ (MRAC, Tervuren). ZAIRE ('Belgian Congo'): Likosi, 1 ♀ (UM, Oxford); N. Kivu, x. 1931 (*C. Seydel*), 1 ♂; Elisabethville, i, x, xi (*C. Seydel*), 2 ♂, 2 ♀ (MRAC, Tervuren), 1 ♂, 1 ♀ (ZSBS, Munich); Katanga, Kipopo (E'ville), x–xii. 1961 (*Don R. Maréchal*), 1 ♀; Lubumbashi, xi–xii. 1926 (*C. Seydel*), 1 ♂, 1 ♀ (all MRAC, Tervuren); Ht Katanga, Shinkolobwe, i.x.1931 (*J. Romieux*), 1 ♂ (BMNH); Lusambo, 21.vi.1949 (*Dr M. Fontaine*), 1 ♀ (MRAC, Tervuren). MALAWI: Mlanje, iii–iv (*H. Barlow*), 1 ♂; Mt Mlanje, iv. 1913 (*S. A. Neave*), 2 ♂; Zomba, ii, iv (*H. Barlow*), 2 ♂; Kasagazi, near Bandawé, 3000 ft above L. Nyassa (*Dr Prentice*), 1 ♂.



MOZAMBIQUE: Ruo Valley, 9.iv.1913 (*S. A. Neave*), 1 ♂ (BMNH); Garuso, 15.ii.1950 (*N. Mitton*), 1 ♀ (TM, Pretoria); Dondo, 12.ix.1954 (*H. Cookson*), 2 ♀ (TM, Pretoria); Dondo Forest, Dondo, x-xi, 2 ♂, 1 ♀ (NMR, Bulawayo). ZAMBIA: Mwengwa, Mopani, 10.viii.1913 (*H. C. Dollman*), 1 ♀; Abercorn, Lake Chila, iv. 1954 (*E. Pinhey*), 1 ♂ (NMR, Bulawayo); Abercorn, ii-iii, v, xi-xii, 1 ♀ (BMNH), 2 ♂ (NMR, Bulawayo), 1 ♂, 1 ♀ (NMK, Nairobi); Upper Luangwa, Luwumbu Valley, 2500-3500 ft, 21.vii.1910 (*S. A. Neave*), 1 ♂; Fort Jameson to Lundazi, 4000 ft (*S. A. Neave*), 1 ♂; Samfya, 31.x.1959, 1 ♂ (NMR, Bulawayo); Ndola, 10.i.1965, 1 ♂ (NMR, Bulawayo); Bwana Mkubwa, ix, xi. 1929 (*Bell-Marley*), 2 ♂, 4 ♀ (BMNH); Broken Hill, 24.ii.1950 (*N. Mitton*), 1 ♂, 2 ♀ (TM, Pretoria); Lusaka, ii, iii, v (*R. C. Dening*), 1 ♂, 2 ♀ (BMNH), 1 ♂ (NMR, Bulawayo); Zambezi Rapids, Mwinilunga, i, v, 3 ♂; 16 miles N. Mwinilunga, iii. 1960, 1 ♂ (all NMR, Bulawayo); Victoria Falls, 20.ii.1911 (*L. A. Sabine*), 1 ♂ (*Zamarada nebulimargo* Prout, paratype). RHODESIA: Salisbury, ii-iv, vi-vii, 3 ♂ (*Zamarada nebulimargo* Prout, paratypes), 2 ♀ (BMNH), 4 ♂ (TM, Pretoria), 3 ♂ (NMR, Bulawayo); Atlantica Research Station, Mellwaine, Salisbury, 6.i.1965, 2 ♂ (NMR, Bulawayo); Selukwe, iv, x, 2 ♂ (*Zamarada nebulimargo* Prout, paratypes), vii-viii, 3 ♂, 2 ♀ (all BMNH); Vumba Mts, Umtali, ii. 1961, 2 ♀ (NMR, Bulawayo); Vumba, 2-9.ii.1959 (*G. van Son*), 1 ♂, 2 ♀; Vumba, Laurenceville, 6-12.iii.1964 (*G. van Son*), 1 ♂, 2 ♀; 25 miles S. of Umtali, 14.ii.1950 (*N. Mitton*), 5 ♂, 1 ♀ (all TM, Pretoria); Umtali, 25.ii.1943 (*R. Carcasson*), 1 ♀; Zimbabwe Ruins, 10.vii.1949 (*H. B. D. Kettlewell*), 1 ♀ (both BMNH); Lundi, 2-5.iii.1964 (*Vári & van Son*), 1 ♂; Van Niekerk Hotel, near Gwaai Bridge, 28-29.iv.1954 (*A. J. T. Janse*), 3 ♂ (all TM, Pretoria). NATAL: Muden, 25-30.ix.1954 (*H. Cookson*), 1 ♀ (TM, Pretoria). ANGOLA: Mt Moco, Luimbale, 1800-1900 m, 13-18.iii.1934 (*Dr K. Jordan*), 3 ♂; Quirimbo, 75 km E. of Amboim, 7-12.v.1934 (*Dr K. Jordan*), 1 ♂, 3 ♀ (all BMNH).

### *Zamarada rubrifascia* Pinhey

(Text-figs 298, 299; Pl. 63, figs 704, 705; Pl. 112, fig. 1013)

*Zamarada rubrifascia* Pinhey, 1962 : 882, pl. 1, fig. 4. Holotype ♂, ZAMBIA (NMR, Bulawayo).

♂ ♀ (Pl. 112, fig. 1013). Frons, head, scape and antennal shaft brownish red (pl. 8, C6); collar greyish yellow (pl. 4, B6, amber); thorax and abdomen dull red (pl. 8, C3) with vinaceous tint, abdomen with a pale medio-dorsal spot on each segment. Hyaline area of wings irrorate with light brown and dull red and finely edged distally with brown; discocellulars on each wing heavily marked, light brown; costa of fore wing amber irrorate with light brown. Non-hyaline terminal area light brown (pl. 6, D6, cinnamon) irrorate with dull red, the dull red in some examples concentrated to form a fascia parallel with the distal margin of the hyaline area. Underside of non-hyaline terminal area greyish orange (pl. 5, B3).

♂ genitalia (Text-figs 298, 299). Uncus short, stout and tapered. Ventral plate of gnathus digitate and coarsely scobinate. Valve with medial ridge; apical fourth of valve scobinate, apical fourth of ventral margin coarsely spined; dorsal process with a short, blunt, setose projection in medial third. Fulcrum almost straight, minutely scobinate apicad.

♀ genitalia (Pl. 63, figs 704, 705). Lamella antevaginalis crenulate along anterior margin, serrate along lateral margins and excavate medially on posterior margin.

Measurements. Fore wing: ♂ 12-14 mm; ♀ 13-15 mm. Antennal pectinations: ♂ 7 ×, ♀ subequal in length to diameter of shaft.

Externally somewhat similar in colour and pattern to *saburra* in the *vulpina*-group, but distinguished by its smaller size, its brightly coloured head and antennae and by the solidly marked, not ringed, discal mark on each wing. Structurally apparently without close relative; placed tentatively in the *metrioscaphes*-group because of the crenulate and serrate-margined sterigma in the female genitalia.

DISTRIBUTION. Zambia, Zaire.

#### MATERIAL EXAMINED.

ZAMBIA: Abercorn, ii. 1954 (*D. Vesey-Fitzgerald*), 1 ♂ (*Zamarada rubrifascia* Pinhey, paratype) (BMNH); ibidem, xii. 1963–ii. 1964, 1 ♀ (NMR, Bulawayo); Abercorn, i–ii. 1956 (*Zamarada rubrifascia* Pinhey, paratypes), 1 ♂ (BMNH), 2 ♂ (NMR, Bulawayo); ibidem, xii. 1962, 1 ♂ (NMR, Bulawayo). ZAIRE ('Belgian Congo'): Shinkolobwe, 3.vi.1931, 1 ♀; Kasai, Sankaru, Bena Dibele, iv. 1959 (*R. H. Carcasson*), 1 ♀ (both BMNH).

### *Zamarada plana* Bastelberger

(Text-figs 300, 301; Pl. 64, figs 706, 707; Pl. 113, figs 1025, 1026)

*Zamarada plana* Bastelberger, 1909 : 101.

♂ genitalia (Text-figs 300, 301). Uncus short, tip finely tapered and curved ventrad. Ventral plate of gnathus minutely scobinate, tip slightly broadened and rounded. Valve simple, apex narrowly rounded; dorsal process with slender, digitate projection near base. Aedeagus finely tapered, without projection. Fulcrum slightly sinuous and serrate on one surface in apical fifth.

♀ genitalia (Pl. 64, figs 706, 707). Posterior margin of lamella antevaginalis irregularly serrate; lamella postvaginalis sclerotized, except for a series of membranous, concentric, semicircular folds medially. Signum stellate, perimeter long-spined.

Two subspecies are recognized, distinguished by the colour and pattern of the wings. The nominate subspecies occurs at Kigonsera in S.W. Tanzania, at Luchenza in Malawi, in Rwanda and in Burundi. Subsp. *denticincta* also occurs in Malawi, at Mt Mlanje, along the Lunchenya river near Mlanje and at Nkata Bay and its distribution extends thence southwards to Cape Province. Specimens of the nominate form occurring in the same locality as subsp. *denticincta* are recorded from Dondo Forest in Mozambique (1 ♂ nominate form, 2 ♂, 1 ♀ *denticincta*), from Weenen, Natal (1 ♀ nominate form, 2 ♂ *denticincta*) and from Mudén, Natal (1 ♂, 1 ♀ nominate form, 3 ♀ *denticincta*).

The pin-data labels give no indication of the vegetation zones in which the specimens were taken; until it is known whether *plana* and *denticincta* represent subspecies or seasonal forms, the two taxa, which are identical in the structure of the genitalia of both sexes, are accorded subspecific rank.

### *Zamarada plana plana* Bastelberger

(Pl. 113, fig. 1026)

*Zamarada plana* Bastelberger, 1909 : 101. LECTOTYPE ♂ TANZANIA (NMS, Frankfurt), here designated [examined].

♂♀. Hyaline area of wings sparsely striate with brown and finely edged distally with dark brown and silvery grey; discal spots minute, dark brown; costa of fore wing buff sparsely striate with brown. Non-hyaline terminal area uniformly brownish orange (pl. 6, C5-C6) very lightly irrorate with a darker shade; dentate subterminal fascia light brown (pl. 6, D6), only weakly defined in apical half of each wing; termen slenderly dark brown.

Measurements. Fore wing: ♂ 16-17 mm; ♀ 15-17 mm. Antennal pectinations: ♂ 12 ×, ♀ 5 × diameter of shaft.

Distinguished from similarly coloured forms of *glareosa* by the presence of a minute discal dot instead of a darkly outlined, ovate spot.

DISTRIBUTION. Tanzania, Malawi, Rwanda, Burundi, Zaire.

#### MATERIAL EXAMINED.

*Zamarada plana* Bastelberger, lectotype ♂ here designated, TANZANIA ('D. Ost Afrika'): Nyasaland, Kigonsera: Coll. Bastelberger: Type no. 2702, in NMS, Frankfurt.

TANZANIA: Kigonsera, 1 ♂ (BMNH), 1 ♂ (ZSBS, Munich). MALAWI: Luchenza, Magunda Estate (*F. Nisbet*), 4 ♂; Luchenza, 30 miles from Blantyre (*N. Nisbet*), 1 ♂ (all BMNH). RWANDA: Kibungu, 1900 m, 26.vi.1951, 1 ♂ (MRAC, Tervuren). BURUNDI: Kitega, 20-23.vi.1966 (*Dr M Fontaine*), 2 ♀ (MRAC, Tervuren). ZAIRE ('Belgian Congo'): Sankaru, Papoolio, 28.viii.1949 (*Dr M. Fontaine*), 1 ♀ (BMNH).

### *Zamarada plana denticincta* Hampson comb. n.

(Pl. 113, fig. 1025)

*Zamarada denticincta* Hampson, 1910 : 469, pl. 39, fig. 6. LECTOTYPE ♂, ZAMBIA (BMNH), here designated [examined].

*Zamarada denticincta* Hampson; Janse, 1932 : 138, pl. 2, fig. 2.

♂♀. Hyaline area of wings tinged with greyish yellow (pl. 4, B4) and finely edged distally with brown and silvery grey; discal spots minute, dark brown; costa of fore wing greyish yellow (pl. 4, B6) sparsely striate with brownish grey. Non-hyaline terminal area brownish grey (pl. 8, C2); dentate subterminal fascia strongly defined, dark brown edged distally with light buff; termen slenderly dark brown.

Measurements. Fore wing: ♂♀ 13-18 mm. Antennal pectinations: ♂ 13 ×, ♀ 4 × diameter of shaft.

Readily distinguished from the nominate subspecies by the greyish yellow hyaline area and by the darker and more strongly patterned non-hyaline terminal area of each wing.

DISTRIBUTION. Kenya, Zaire, Malawi, Mozambique, Zambia, Rhodesia-Transvaal, Natal, Cape Province.

#### MATERIAL EXAMINED.

*Zamarada denticincta* Hampson, lectotype ♂ here designated, ZAMBIA ('N.E. Rhodesia'): East Luangwa Dist., 2400 ft, Petauke, 14.iii.1905 (*S. A. Neave*), Pres. by him and B.S.A. Co.: *Zamarada denticincta* Hampson type ♂ [in Hampson's hand-writing]: Geometridae genitalia slide no. 3642, in BMNH.

KENYA: Kilifi, Sokoke Forest, iv. 1960 (*J. G. Williams*), 1 ♂ (NMK, Nairobi). ZAIRE ('Belgian Congo'): Elisabethville, 14.xii.1955 (*C. Seydel*), 1 ♂; Kikura R., Lifura Valley, 5.v.1919 (*T. A. Barns*), 1 ♂. MALAWI: Mt Mlanje, i-v, xi-xii (*S. A. Neave*), 34 ♂, 13 ♀; Mlanje Boma, 2400 ft, 30.iv.1910 (*S. A. Neave*), 1 ♂; Mlanje, Luchenyia R., i, ii, xii (*S. A. Neave*), 8 ♂, 1 ♀ (all BMNH); Nkata Bay, x-xii, 2 ♂, 1 ♀ (NMR, Bulawayo). MOZAMBIQUE: Kola Valley, 6-7.iv.1913 (*S. A. Neave*), 3 ♂ (BMNH); Chironde, 30 miles E. of Inhaminga, 22.v.1969, 1 ♀ (*plana* form); Zambezia Prov., 16 miles N.E. of Molumbo, 30.iv.1970, 1 ♂; 16 miles S. of Vila Junqueiro, 1.v.1970, 1 ♂; 78 miles N.W. of Quelimane, 3.v.1970, 2 ♂; Salone R., 25 miles S. of Marromeu, 8.xi.1965, 1 ♂; Panga Panga Forest, Inhamitanga, 31.x.1963, 1 ♂, 1 ♀; Chiluvo Hills, Vila Machado, x. 1963, 1 ♀; ibidem, 13.xi.1967, 1 ♂ (all *E. Pinhey*, NMR, Bulawayo); Dondo Forest, N.W. of Beira, 9-19.viii.1952 (*K. M. Pennington*), 1 ♂ (*plana* form) (TM, Pretoria); Dondo, 3-4.xi.1967 (*E. Pinhey*), 2 ♂, 1 ♀ (NMR, Bulawayo); Delagoa Bay (*Mrs Monteiro*), 2 ♂, 3 ♀ (BMNH). ZAMBIA: Mid Chambezi Valley, Chinsali District, 4000 ft, 18.iv.1908 (*S. A. Neave*), 1 ♂ (*Zamarada denticincta* Hampson, paralectotype); lectotype locality, 11.iii.1905, 1 ♂ (*Zamarada denticincta* Hampson, paralectotype); ibidem, 27.iii.1905, 1 ♂ (*Zamarada denticincta* Hampson, paralectotype) (all UM, Oxford). RHODESIA: Vumba, Umtali District, iv (*P. A. Sheppard & Barnes*), 1 ♂ (NMR, Bulawayo); Mt Selinda, 9-17.iv.1956 (*van Son & Vári*), 1 ♂; Lundi, iii-iv (*van Son & Vári*), 3 ♀; Lundi River Bridge, 2 miles N.E., 3.iv.1954 (*A. J. T. Janse*), 1 ♂ (all TM, Pretoria). TRANSVAAL: Zoutpansberg, Grt Saltpan, 14-16.v (*D. W. Rorke*), 1 ♀; Politsi, 14-28.ii.1963 (*H. Geertsema*), 1 ♀; Kruger National Park, Punda Milia, 1-5.xii.1964 (*Vári & Potgieter*), 1 ♀; K. N. P., Satara, 29.iv-2.vi.1968 (*Potgieter & Goode*), 9 ♀; K. N. P., Nwanedzi, 30.iv-1.v.1968 (*Potgieter & Goode*), 9 ♀; ibidem, 29-30.iv.1969 (*Potgieter & Strydom*), 4 ♀; K.N.P., Skukusa, 26-28.iv.1968 (*Potgieter & Goode*), 3 ♂, 1 ♀; Hectorspruit, i-ii. 1965 (*Mrs Granville*), 1 ♂, 2 ♀; Malelane, 24.iii.1952 (*Janse & Vári*), 1 ♀; Mariepskop, 15-24.iii.1965 (*Potgieter & E. van Son*), 1 ♀; Pretoriuskop, 1.iv.1952 (*L. Vári*), 1 ♀ (all TM, Pretoria); White River, iii. 1909 (*A. T. Cooke*), 1 ♂ (*Zamarada denticincta* Hampson, paralectotype). NATAL: Lebombo Mts, Jozini Dam, 9-14.i.1965 (*L. Vári*), 4 ♂, 10 ♀; Hluhluwe, x. 1953 (*K. M. Pennington*), 1 ♂, 1 ♀; Muden, 26.ii.1955 (*H. Cookson*), 1 ♀; ibidem, 24.iv.1954, 1 ♀ (*plana* form) (all TM, Pretoria); ibidem, xii. 1953, 1 ♀ (NMK, Nairobi), 1 ♀ (NMR, Bulawayo); Weenen, i-ii, 2 ♂ (BMNH); ibidem, x. 1896, 1 ♀ (*plana* form) (UM, Oxford); Umkomaas, 27.iii.1915, 1 ♀ (TM, Pretoria); Umbilo, iii. 1907 (*G. F. Leigh*), 1 ♂, 1 ♀ (BMNH). CAPE PROVINCE: East London, 19.iii.1913 (*G. F. Leigh*), 2 ♂ (BMNH); Zuurberg Pass, 21.iii.1954 (*L. Vári*), 1 ♂; Witteklip, 10.v.1950 (*C. G. C. Dickson*), 1 ♂ (both TM, Pretoria).

### *Zamarada varii* sp. n.

(Text-figs 302, 303; Pl. 64, figs 708, 709; Pl. 113, fig. 1024)

♂ genitalia (Text-figs 302, 303). Uncus tapered. Ventral plate of gnathus minutely scobinate, apex rounded. Valve with diagonal ridge from mid-base to near apex of ventral



margin; apex truncate; occasionally a short projection from ventral margin just below apex; dorsal process with a very slender, digitate projection near base. Aedeagus finely tapered; a short, digitate and a strongly sclerotized, laterally inclined, thorn-like projection, each at one-half.

♀ genitalia (Pl. 64, figs 708, 709). Posterior margin of lamella antevaginalis finely serrate medially, irregularly serrate laterally. Perimeter of signum serrate.

Similar in colour and pattern to *plana denticincta*, but differing in the deeper distal extension of the hyaline area between veins  $M_3$  and  $Cu_{1b}$  on each wing, reminiscent of the oriental *excisa*. The non-hyaline terminal area in *varii* is paler and greyer than that of *plana denticincta* (Pl. 113, fig. 1024).

Measurements. Fore wing: ♂ 13–14 mm; ♀ 15–17 mm. Antennal pectinations: ♂ 9 ×, ♀ 5 × diameter of shaft.

Distinguished structurally from *plana denticincta* by the shorter pectinations of the male antennae, their maximum length being nine instead of thirteen times the diameter of the shaft; by the form of the valve and of the aedeagus in the male genitalia; by the finely serrate medial region of the lamella antevaginalis and the shortly serrate perimeter of the signum in the female genitalia.

It is with pleasure that I name this species in honour of Dr Lajos Vári of the Transvaal Museum, in token appreciation of his frequent very kind help.

DISTRIBUTION. Kenya, Tanzania, Mozambique, Zambia, Rhodesia, Transvaal, Natal.

Holotype ♂, NATAL: Zululand, Kosi Lake, 28.i.1959 (J. H. Grobler), in TM, Pretoria.

Paratypes. KENYA: Nyali, xii. 1968 (D. G. Sevastopulo), 2 ♂; ibidem, 12.x.1969, 1 ♂ (both BMNH); Mombasa (Doherty), 1 ♂ (CM, Pittsburgh). TANZANIA: E. Usambara Mts, Amani, xi. 1965, 1 ♂ (NMK, Nairobi); Mhonda, 1 ♂ (BMNH); Bagamoyo, i. 1893, 1 ♂ (MNHU, Berlin). MOZAMBIQUE: Beira, iii. 1904 (P. A. Sheppard), 1 ♂; Lorenzo Marquez (Distant), 1 ♂; Delagoa Bay, Catembe, i. 1916 (Habernicht), 1 ♀ (all BMNH). ZAMBIA: Victoria Falls, Big Tree, 6.v.1954, 1 ♂; Victoria Falls, near Palm Grove, 14.v.1954, 1 ♂; 8 miles north of Livingstone, 25–28.v.1954, 1 ♀ (all A. J. T. Janse in TM, Pretoria). RHODESIA: 15 miles S. of Wankie, 30.iv.1954 (A. J. T. Janse), 1 ♀. TRANSVAAL: Shingwedzi, 29.iii.1952 (Janse & Vári), 1 ♀. NATAL: Ingwavuma, 6–9.ii.1968 (Potgieter & Jones), 1 ♂; holotype data, 2 ♂, 2 ♀ (all TM, Pretoria).

### *Zamarada astyphele* (Prout MS) sp. n.

(Text-figs 304, 305; Pl. 65, figs 710, 711; Pl. 113, fig. 1027)

♂ ♀ (Pl. 113, fig. 1027). Hyaline area of wings irrorate with brownish orange and edged distally with light brown; irroration dense along costa of fore wing, sparse along its posterior margin; discal spot on fore wing ovate, light grey edged with dark grey, that on hind wing minute, dark grey. Non-hyaline terminal area brownish orange (pl. 5, C3); terminal interneural dots black. In some examples there is a dark grey subterminal fascia, more strongly defined on the fore wing. Underside of non-hyaline terminal area greyish brown (pl. 5, D3), paler terminad.

♂ genitalia (Text-figs 304, 305). Uncus short, stout and tapered. Ventral plate of gnathus digitate and minutely scobinate. Valve with a short medial, diagonal ridge; apex of valve sclerotized and broadly rounded; dorsal process with long, slender, digitate, setose process near base. Aedeagus tapered and blade-like with two rounded projections medially. Fulcrum sinuous apicad, tip heavily spined and extending beyond that of aedeagus.

♀ genitalia (Pl. 65, figs 710, 711). Sterigma strongly sclerotized; posterior margin of lamella antevaginalis excavate medially, margin minutely serrate; surface scobinate.

Measurements. Fore wing: ♂ 16–17 mm; ♀ 15–16 mm. Antennal pectinations: ♂ 14 ×, ♀ 5 × diameter of shaft.

Distinct in colour and in the almost straight, distal margin of the hyaline area of the wings. The simple valve structure is similar to that found in a number of species related to *bernardii* in the *protrusa*-group, but the valve lacks the dense covering of short hair-scales on the dorsal surface found in those species; distinguished further from them by the shorter, stouter uncus, the well developed gnathus and the form of the aedeagus.

DISTRIBUTION. Zaire, Gabon, Angola.

Holotype ♂, ANGOLA: S. Oc., Bolongongo (30 km from Canzele), 13.xi.1957 (*Gerd Heinrich*), in ZSBS, Munich.

Paratypes. ANGOLA: Prov. Nordcuanza, Canzele, 30 km nördl. Quiculungo, 22.xi.1957 (*Gerd Heinrich*), 1 ♀ (ZSBS, Munich). GABON: Belinga, Camp Central, 500 m, 25.ii.1953 (*G. Bernardi*), 1 ♂ (MBG, Paris). ZAIRE ('Belgian Congo'): Equateur, Bokuma, 10.x.1941 (*Rev. P. Hulstaert*), 1 ♂; Mongupa Bangala, 23.ix.1927 (*A. Collart*), 1 ♂; Sankuru, Katako-Kombe, 11.ii.1953 (*Dr Fontaine*), 1 ♂; Uele, Paulis, 25.viii.1953 (*Dr M. Fontaine*), 1 ♀ (all MRAC, Tervuren); W. Kivu, south of Walikali, south side of middle Lowa Valley, 3500 ft, forest, wet season, iii. 1924 (*T. A. Barns*), 1 ♂ (BMNH).

### *Zamarada griseola* sp. n.

(Text-figs 306, 307; Pl. 65, figs 712, 713; Pl. 114, fig. 1028)

♂ ♀ (Pl. 114, fig. 1028). Similar in colour and pattern to *astyphela*, differing in the extension of the hyaline area of each wing into the brownish orange terminal third between veins  $M_3$  and  $Cu_{1b}$ . In the male the pectinations of the antennae are slightly shorter than in *astyphela*, being eleven times instead of fourteen times as long as the diameter of the shaft.

♂ genitalia (Text-figs 306, 307). These differ from *astyphela* in the form of the strongly sclerotized, sharply tapered apical half of each valve and in the form of the coarsely scobinate, asymmetrical apex of the fulcrum, which has a scobinate projection at the left side.

♀ genitalia (Pl. 65, figs 712, 713). Closely similar to those of *astyphela*.

Measurements. Fore wing: ♂ 16–18 mm; ♀ 15–17 mm. Antennal pectinations: ♂ 11 ×, ♀ 5 × diameter of shaft.

DISTRIBUTION. Nigeria, Cameroun, Fernando Po.

Holotype ♂, NIGERIA: north, Mambilla Plateau, Karmantan Forest, 5500 ft, 10.xii.1968 (*H. Roberts*), Geometridae genitalia slide no. 7678, in BMNH.

Paratypes. NIGERIA: holotype data, 1 ♂ (IAR, Zaria), 1 ♀ (BMNH); Omo, vii. 1960 (*J. Boorman*), 1 ♀; Ilesha (*Capt. Humfrey*), 1 ♂ (both BMNH).

Associated with *griseola*, but excluded from the type-series because only females are known:

CAMEROUN: Johann-Albrechts Höhe, 1896 (*L. Conradt*), 1 ♀; Lolodorf, 1894-95 (*L. Conradt*), 1 ♀ (both BMNH); Misellele, 14.i.1936 (*Dr Zumpt*), 1 ♀ (MRAC, Tervuren). FERNANDO PO (*W. Cooper*), 1 ♀ (BMNH).

### *Zamarada euerces* Prout

(Text-figs 308, 309; Pl. 66, figs 714, 715; Pl. 114, fig. 1029)

*Zamarada euerces* Prout, 1928 : 69. Holotype ♂ SIERRA LEONE (BMNH) [examined].

*Zamarada euerces phygas* Prout, 1928 : 70. Holotype ♀, TANZANIA [not found]. **Syn. n.**

♂ ♀ (Pl. 114, fig. 1029). Hyaline area of wings weakly striate with brownish grey; costal area of fore wing light buff irrorate with grey; discal spot on fore wing large and ovate, pale grey edged with darker grey, that on hind wing similar, but smaller. Non-hyaline terminal area of each wing orange-grey (pl. 5, B2) sparsely irrorate with black and varying suffused with brownish grey (pl. 5, C2); dentate subterminal fascia broken and irregular, brownish orange edged distally with black. Underside of non-hyaline terminal area uniformly greyish brown.

♂ genitalia (Text-figs 308, 309). Uncus short and tapered with a slender, keel-like, dorsal ridge; blunt tip slightly produced ventrad. Ventral plate of gnathus minutely scobinate, tip rounded. Apex of valve narrowly rounded and incurved towards uncus; a thorn-like projection at mid-valve just below apex; dorsal process with a slender, digitate, setose projection in basal fourth. Aedeagus dilate medially with a short, rounded, digitate projection at one-half right side and a minute, thorn-like projection just apicad of it, apical half blade-like, finely tapered.

♀ genitalia (Pl. 66, figs 714, 715). Posterior margin of lamella antevaginalis minutely serrate and broadly and deeply excavate medially; lamella postvaginalis weakly sclerotized. posterior margin with U-shaped excavation medially.

Prout proposed the subspecific name *phygas* for Tanzanian examples, which were recorded as having on average narrower, non-hyaline terminal areas and smaller discal spots. Further material, not available to Prout at the time, has shown these characters to vary and *phygas* is therefore synonymized with *euerces*.

Externally distinct in colour and in the presence of the large, ovate, dark-edged, pale grey discal spot on each fore wing. Structurally the form of the valve, with the thorn-like projection just below the apex, and of the aedeagus in the male and the form of the sterigma in the female genitalia are diagnostic.

DISTRIBUTION. West Africa, Senegal to Gabon, Zaire, Uganda, Kenya, Tanzania, Mozambique.

#### MATERIAL EXAMINED.

*Zamarada euerces* Prout, holotype ♂, SIERRA LEONE: Geometridae genitalia slide no. 1458, in BMNH. *Zamarada euerces phygas* Prout, paratype ♀, TANZANIA ('D. O. Afrika'): Tendaguru Bez. Lindi (*Janensch S.G.*), Geometridae genitalia slide no. 1460, in BMNH. The holotype ♀ from Mikindani, Tanzania is recorded by Prout as in MNHU, Berlin, but it cannot at present be traced in that institution.

SENEGAL: Sedhiou, 1917 (*H. Castell*), 1 ♂. IVORY COAST: Bingerville, 11-14.viii.1915 (*G. Melou*), 1 ♀ (BMNH); Lamto, 36 km N.N.W. of Tiassalé, 20-23.iv.1969 (*C. Herbulot*), 1 ♂ (coll. Herbulot, Paris). GHANA: N. Territories, Kete-Krachi (*A. W. Cardinall*), 2 ♂, 1 ♀. NIGERIA: Jos, v. 1960 (*J. Boorman*), 1 ♂; Ibadan, 21.vii.1960 (*H. Sutton*), 1 ♂. CAMEROUN: Lolodorf, 1894 (*L. Conradt*), 1 ♂; Johann-Albrechts Höhe, 1896 (*L. Conradt*), 1 ♂ (all BMNH); Ngoko-Stat. (*Hösemann*), 1 ♂ (MNHU, Berlin); Epulan, 30.iii.1926 (*G. Schwab*), 1 ♂ (*Zamarada euerces* Prout, paratype) (BMNH); Efulen, 12-18.v.1913 (*H. L. Weber*), 2 ♂ (CM, Pittsburgh). GABON: Belinga, 1000 m, N. Crête Sud, 29.iii.1963 (*G. Bernardi*), 1 ♂; Franceville, 29.i.1964 (*P. Darge*), 1 ♂ (both coll. Herbulot, Paris). ZAIRE ('Belgian Congo'): Elisabethville, 6.v.1953 (*C. Seydel*), 1 ♂. UGANDA: Ankole, Kalinzu Forest, xi. 1961 (*R. H. Carcasson*), 1 ♂. KENYA: Nyalı, 29.iv.1970 (*D. G. Sevastopulo*), 1 ♀ (all BMNH). TANZANIA: Usambara, Amani, 21-30.iv.1969 (*Watulege*), 1 ♂ (coll. Herbulot, Paris); ibidem, iv. 1965 (*R. H. Carcasson*), 1 ♀ (NMK, Nairobi); Dar-es-Salaam, Minaki, 27.i.1965 (*N. G. Webb*), 1 ♀; Tendaguru, 31.v.1925, East Africa Exp. (*W. E. Cutler*), 1 ♀ (both BMNH); Nachingwea, iv. 1961 (*W. Bigger*), 1 ♀ (NMK, Nairobi); Kigonsera, 29.i.1960 (*Pater O. Morger*), 1 ♂ (ZSBS, Munich). MOZAMBIQUE: Chiluvo Hills, Vila Machado, 31.x.1967 (*E. Pinhey*), 1 ♂; Dombe, 10.iii.1970 (*E. Pinhey*), 1 ♂ (both NMR, Bulawayo).

***Zamarada geitaina* sp. n.**

(Text-figs 310, 311; Pl. 114, fig. 1032)

♂ (Pl. 114, fig. 1032). Hyaline area of wings tinged with dull yellow, very sparsely striate with greyish orange and slenderly edged distally with greyish brown; discal spots slender, that on fore wing ovate, greyish orange; costal area of fore wing greyish orange irrorate with greyish brown. Non-hyaline terminal area greyish orange (pl. 5, B3); subterminal fascia dentate, greyish brown edged distally with silvery grey; termen slenderly greyish brown. Underside of non-hyaline terminal area uniformly greyish brown.

♂ genitalia (Text-figs 310, 311). Uncus short, stout and tapered, tip curved ventrad. Ventral plate of gnathus strongly sclerotized and minutely scobinate, digitate in form. Valve: medial third with short, diagonal ridge; apical half of dorsal margin deeply excavate; apex diagonally truncate, apical margin one-half as wide as greatest width of aedeagus; dorsal process with slender, digitate, setose projection near base. Aedeagus dilate at two-thirds with a diagonally transverse, semi-circular, blade-like projection; apical third finely tapered. ♀ unknown.

Measurements. Fore wing: ♂ 14-16 mm. Antennal pectinations: ♂ 14 × diameter of shaft.

Externally similar to *griseola*, but differing in the presence of a well-defined subterminal fascia on each wing. In the male genitalia the form of the valve and aedeagus is diagnostic.

DISTRIBUTION. Ivory Coast.

Holotype ♂, IVORY COAST ('Afrique Occidentale, Côte d'Ivoire'): Bingerville, xi. 1913 (*Gaston Melou*), Geometridae genitalia slide no. 7698, in BMNH.

Paratypes. IVORY COAST: Bingerville, 20-31.v.1915 (*G. Melou*), 1 ♂; ibidem,



1.vi.1915, 1 ♂; 1-14.vii.1915, 1 ♂; 5-20.vii.1915, 1 ♂; 15-28.ix.1915, 1 ♂ (all BMNH); Yapo-Sud, 22 km S.S.E. of Agboville, 12-18.iv.1969 (C. Herbulot), 1 ♂ (coll. Herbulot, Paris).

### *Zamarada phrontisaria* Swinhoe

(Text-figs 312, 313; Pl. 68, figs 722, 723; Pl. 114, fig. 1031)

*Zamarada phrontisaria* Swinhoe, 1904: 517. LECTOTYPE ♂, NIGERIA (BMNH), here designated [examined].

♂ ♀ (Pl. 114, fig. 1031). Hyaline area of wings greyish yellow (pl. 4, B3), with a distinct copper-coloured tint in oblique light, and finely edged distally with light brown; discal spot on fore wing large and ovate, silvery grey edged with light brown, that on hind wing slender and light brown; costal area of fore wing irrorate with greyish brown and with silvery grey at base. Non-hyaline terminal area of each wing very pale grey sparsely irrorate with brown; dentate subterminal fascia brownish orange (pl. 5, C6) finely edged distally with silvery white; the brownish orange is diffused to termen in discal area of each wing and to tornus of fore wing; termen slenderly dark brown; cilia chequered very light grey and silvery grey. Underside of non-hyaline terminal area uniformly greyish brown.

♂ genitalia (Text-figs 312, 313). Uncus similar to that of *geitaina*. Ventral plate of gnathus slightly broadened to an almost truncate apex. Valve: dorsal margin deeply excavate at two-thirds; truncate apex equal in width to greatest width of aedeagus; dorsal process with a slender, digitate, setose projection in basal fourth. Aedeagus dilate at one-half with a weakly developed digitate projection at right side.

♀ genitalia (Pl. 68, figs 722, 723). Posterior margin of lamella antevaginalis minutely serrate; a shallow U-shaped excavation at middle of margin. Lamella postvaginalis sclerotized; posterior margin produced medially, as illustrated. Corpus bursae sclerotized in posterior ninth.

Externally one of the more distinctive species in the genus, readily recognizable by the strikingly copper-coloured hyaline area, apparent in an oblique light and the predominantly very pale grey non-hyaline terminal area. In the male genitalia the form of the valve and aedeagus and in the female genitalia the form of the lamella postvaginalis are diagnostic.

DISTRIBUTION. Gambia, Nigeria, Cameroun, Gabon.

#### MATERIAL EXAMINED.

*Zamarada phrontisaria* Swinhoe, lectotype ♂ here designated, NIGERIA: Old Calabar, '*Zamarada phrontisaria* ♂ Swinhoe type' [in Swinhoe's hand-writing]: Geometridae genitalia slide no. 6426, in BMNH.

GAMBIA (*Moloney*), 1 ♂. NIGERIA: R. Niger, Sapele (*F. W. Sampson*), 1 ♂ (*Zamarada phrontisaria* Swinhoe, paralectotype); Warri, v (*Dr Roth*), 1 ♂, 1 ♀; Ilesha (*Capt. Humfrey*), 1 ♀; Old Calabar, 1 ♀ (UM, Oxford), 1 ♀ (*Zamarada phrontisaria* Swinhoe, paralectotype, in BMNH). CAMEROUN: Johann-Albrechts Höhe, 6.v.1896 (*L. Conradt*), 1 ♀ (MNHU, Berlin); Efulen, i-ix (*H. L. Weber*), 8 ♂, 5 ♀; ibidem, x, 14 ♂, 7 ♀ (all CM, Pittsburgh). GABON: Abanga, 24.xi.1968 (*P. Darge*), 1 ♀ (coll. Herbulot, Paris).

*Zamarada fumosa* Gaede

(Text-figs 314, 315; Pl. 66, figs 716, 717; Pl. 114, fig. 1030)

*Zamarada fumosa* Gaede, 1915 : 118, pl. 2, fig. 12 (as *flava*). Holotype ♂, CAMEROUN (MNHU, Berlin) [examined].*Zamarada flava* Gaede, 1915 : pl. 2, fig. 12.

♂♀ (Pl. 114, fig. 1030). Hyaline area of wings tinged and irrorate with dull greyish yellow, displaying a copper-coloured tinge in oblique light, and finely edged terminally with brown; discal spot on fore wing ovate, greyish yellow to brownish orange, with a small but distinct brown spot at base of vein  $M_2$ , that on hind wing slender and dark brown; costal area of fore wing brownish orange, irrorate with greyish brown. Non-hyaline terminal area uniformly brownish orange (pl. 5, C5) very sparsely irrorate with dark brown; termen slenderly dark brown; subterminal fascia dentate and broken, very weakly defined in a shade darker than the ground colour. Underside of non-hyaline terminal area greyish brown, markedly paler terminad; discal spots on fore wing large and ill-defined, greyish brown.

♂ genitalia (Text-figs 314, 315). Uncus similar to that of *euerces*. Ventral plate of gnathus similar to that of *phrontisaria*. Apex of valve shallowly bifurcate, ventral and dorsal apices tapered; dorsal process with a slender, digitate, setose projection near base. Aedeagus dilate medially with two projections, one semi-circular and ridge-like, one digitate; apex finely tapered. Apex of fulcrum scobinate and tipped with a stout spine, extending beyond apex of aedeagus.

♀ genitalia (Pl. 66, figs 716, 717). Posterior margin of lamella antevaginalis serrate, minutely medially, more coarsely towards and along lateral margins; a broad V-shaped excavation in middle of posterior margin. Lamella postvaginalis much wrinkled medially, with a small sclerotized plate.

Measurements. Fore wing: ♂ 15-17 mm; ♀ 12-17 mm. Antennal pectinations: ♂ 14 ×, ♀ 3 × diameter of shaft.

Differs in colour from *griseola* and *astyphela* in the copper-coloured tinge to the hyaline area, apparent in oblique light, and in the more orange-brown colour of the non-hyaline terminal area; differs in pattern in the broader distal penetration by the hyaline area of each wing between veins  $M_3$  and  $Cu_{1b}$ . In the male the strongly dilate hind tibia, which bears a dense tuft of long hair scales, separates *fumosa* readily from *griseola* and *geitaina*. In the male genitalia the form of the valve and aedeagus and in the female the form of the sterigma are diagnostic.

DISTRIBUTION. Zaire, Cameroun, Nigeria.

## MATERIAL EXAMINED.

*Zamarada fumosa* Gaede, holotype ♂, CAMEROUN: Lolodorf, 14.v.1895 (*L. Conradt*), in MNHU, Berlin.

CAMEROUN: Lolodorf (*L. Conradt*), 1 ♂ (*Zamarada fumosa* Gaede paratype, in MNHU, Berlin); Johann-Albrechts Höhe, 1898 (*L. Conradt*), 1 ♂, 2 ♀ (BMNH); ibidem, 1.vi.1896, 3 ♂, 1 ♀ (MNHU, Berlin); Efulen (*Good*), 1 ♀; Efulen, iii-vi (*H. L. Weber*), 6 ♂, 2 ♀; ibidem, viii, 1 ♂, 2 ♀; ix, 3 ♂, 4 ♀; x, 18 ♂, 13 ♀; xi-xii, 3 ♂, 2 ♀ (all CM, Pittsburgh); N'Kongsamba, 15.i.1958 (*P. Darge*), 1 ♀; Victoria, Route forest sud, 24.x.1970 (*P. Darge*), 1 ♀; Ewonda (route Buea-VHF transmitter on Mt Cameroun), 900 m, 23-27.x.1971 (*P. Darge*), 1 ♂ (all coll. Herbulot, Paris). GABON: Savanes de Mwadi, près du Iézé, 1.iv.1963 (*G. Bernardi*), 1 ♂ (MBG, Paris);

Franceville, 26.ix.1963 (*P. Darge*), 1 ♂; Mouila, ix-x. 1964 (*P. Darge*), 2 ♂, 3 ♀ (coll. Herbulot, Paris). ZAIRE ('Belgian Congo'): Equateur, Ikola, iii. 1959 (*R. H. Carcasson*), 1 ♂; Prov. Orientale, Lomami R., Opala, iii. 1959 (*R. H. Carcasson*), 1 ♂ (both NMK, Nairobi); Sankaru, Katako-Kombe, ii, iii, x (*Dr M. Fontaine*), 3 ♂; Lusambo, 30.vi.1949 (*Dr M. Fontaine*), 1 ♂ (all MRAC, Tervuren); W. Kivu, S. of Walikali, south side middle Lowa Valley, 3500 ft, forest, wet season, iii. 1924 (*T. A. Barns*), 1 ♂ (BMNH).

### *Zamarada cathetus* sp. n.

(Text-figs 316, 317; Pl. 67, figs 718, 719; Pl. 114, fig. 1033)

♂ ♀ (Pl. 114, fig. 1033). Proximal two-thirds of each wing thinly scaled, light buff very sparsely irrorate with cinnamon-brown; costa of fore wing and straight postmedial fascia, forming distal margin of thinly scaled proximal area, cinnamon-brown mixed with a darker shade; discal marks very slender, cinnamon-brown. Non-hyaline terminal third of each wing dark buff irrorate with cinnamon-brown. Underside of non-hyaline terminal third of each wing brown, darker proximad towards postmedial fascia, paler terminad; proximal two-thirds of each wing light buff, discocellulars brown.

♂ genitalia (Text-figs 316, 317). Uncus stout and tapered. Ventral plate of gnathus minutely scobinate, tip rounded. Valve abruptly narrowed at one-half dorsal margin, then strongly sclerotized to truncate apex, ventral and dorsal apices angular; dorsal process with a slender, digitate, setose projection in basal fourth. Aedeagus dilate medially with two rounded projections, one digitate, one broader and semi-circular. Apex of fulcrum sinuous, dilate and very densely spined.

♀ genitalia (Pl. 67, figs 718, 719). Lamella antevaginalis with irregular pattern of thorn-like projections along lateral and posterior margins; posterior margin shallowly excavate. Lamella postvaginalis with series of dense U-shaped folds and a small sclerotized plate medially. Posterior tenth of corpus bursae sclerotized.

Measurements. Fore wing: ♂ 15.5-17.0 mm; ♀ 14-16 mm. Antennal pectinations: ♂ 9 ×, ♀ 3 × diameter of shaft.

Strikingly distinct in colour and pattern. Structurally appears most closely related to *fumosa*, from which it differs in the male in lacking the dilate hind tibia of that species; in the narrower, truncate valve and the more densely spined apex of the fulcrum in the genitalia; in the female genitalia the form of the sterigma is diagnostic.

DISTRIBUTION. Cameroun, Gabon.

Holotype ♂, CAMEROUN: Efulen, 17.vi.1922 (*H. L. Weber*), in CM, Pittsburgh.

Paratypes. CAMEROUN: Efulen, 18.ii.1922 (*H. L. Weber*), 1 ♀; ibidem, 29.iv.1922, 1 ♂; 11.v.1923, 1 ♀; 11.vi.1922, 1 ♂; 9.ix.1922, 1 ♂; 10.x.1922, 1 ♂; 21.x.1922, 1 ♀; 27.x.1922, 1 ♂; 30.x.1924, 1 ♀; 15.xi.1924, 1 ♀; 19.xi.1922, 1 ♀; 13.xii.1922, 1 ♀; 27.xii.1921, 2 ♀ (all CM, Pittsburgh); Lolodorf, 1894-1895 (*L. Conradt*), 2 ♀ (BMNH). GABON: Belinga, Camp Central, 500 m, 25.iii.1963, 2 ♂; ibidem, 700 m, 14.iii.1963, 1 ♀; ibidem, 25.iii.1963, 1 ♂; Belinga, Grande Crête Sud, 900 m, 29.iii.1963, 1 ♀ (all *G. Bernardi*, in MBG, Paris).

*Zamarada unisona* sp. n.

(Text-figs 318, 319; Pl. 67, figs 720, 721; Pl. 114, fig. 1034)

♂ ♀ (Pl. 114, fig. 1034). Wings thinly scaled, except along costa of fore wing, light buff irrorate with grey, usually very sparsely, rarely densely; discal spots minute. Underside of wings: costa and cilia of each wing light buff; remainder hyaline with vinaceous tinge in oblique light.

♂ genitalia (Text-figs 318, 319). Uncus and gnathus similar to those of *cathetus*. Valve broader medially than in related species, then evenly tapered to obliquely truncate apex, tip of dorsal margin strongly sclerotized and acutely angled; dorsal process with slender, digitate, setose projection in basal fourth. Aedeagus blade-like in apical half; two rounded projections at one-half. Apex of fulcrum asymmetrical, similar to that of *griseola*.

♀ genitalia (Pl. 67, figs 720, 721). Posterior margin of lamella antevaginalis with irregular pattern of spine-like projections, similar to those found in *cathetus*, and a U-shaped medial excavation. Lamella postvaginalis with sclerotized medial plate, similar to that found in *phrontisaria*. Corpus bursae sclerotized at posterior extremity.

Measurements. Fore wing: ♂ 15–17 mm; ♀ 16–17 mm. Antennal pectinations: ♂ 12 ×, 3 × diameter of shaft.

Externally strikingly distinct in colour and lack of pattern; *acosmeta* Prout, in the *acosmeta*-group, with which worn examples might be confused, may be distinguished by the presence of a slender brown terminal band.

DISTRIBUTION. Zambia, S.E. Zaire, Angola.

Holotype ♂, ZAIRE ('Belgian Congo'): Elisabethville, xi. 1948 (C. Seydel), in MRAC, Tervuren.

Paratypes. ZAMBIA: Abercorn, xi. 1963 (E. S. Brown), 1 ♂ (NMK, Nairobi); Bwana Mkubwa (N. W. Bell-Marley), 1 ♂; ibidem, ix. 1929, 1 ♀ (both BMNH); Ndola, 10.i.1965, 5 ♂; ibidem, 29.i.1965, 1 ♀; xii. 1960, 1 ♂ (all NMR, Bulawayo); Nkana, xi. 1933 (Mrs Prismall), 1 ♂; ibidem, xii. 1933, 2 ♂ (all TM, Pretoria); Mwinilunga, v. 1961, 1 ♂; Mwinilunga, Lisombo River, 29.iv.1963, 1 ♂ (both NMR, Bulawayo). ZAIRE ('Belgian Congo'): Elisabethville, 23.i.1949 (C. Seydel), 1 ♂; ibidem, 16.iii.1930, 1 ♀; 4.viii.1951, 1 ♂; x. 1950, 1 ♂, 1 ♀; 2.xi.1948, 1 ♂; 17.xi.1949, 1 ♀; 18.xi.1948, 1 ♂; 25.xi.1948, 2 ♀; 29.xi.1948, 1 ♂, xii. 1948, 1 ♀; 3.xii.1948, 1 ♀; 16.xii.1948, 1 ♂ (all MRAC, Tervuren); ibidem, 6.ii.1954, 1 ♀; 21.iv.1955, 1 ♂; 11.x.1952, 1 ♂; 14.x.1955, 1 ♀; 7.xi.1951, 1 ♀; 9.xi.1956, 1 ♀; 16.ix.1952, 1 ♀; 18.ix.1952, 1 ♂; 19.ix.1952, 1 ♂; 22.xi.1951, 1 ♂ (all BMNH). ANGOLA: Bihé, Gamba, xii. 1934 (R. Braun), 4 ♂, 1 ♀; ibidem, i. 1935, 2 ♂ (all BMNH).

THE *ACOSMETA*-GROUP

Species included in this group are characterized externally by the extension of the hyaline area almost to the termen on each wing; the non-hyaline area is reduced to an apical patch on the fore wing and a slender, terminal band elsewhere or, as in *acosmeta*, reduced to a slender terminal band on each wing; discal spots minute or absent.



Characterized in the male genitalia by the asymmetrical, bifid, spine-tipped fulcrum; by the spirally twisted tenth tergite and sternite with the uncus situate ventrally and the ventral plate of the gnathus dorsally; by the greatly reduced and tapered membranous valve and its densely setose dorsal process, broad at base, thence straight to a narrowly rounded unspined apex.

Characterized in the female genitalia by the presence of a hollow-stemmed, leaf-like process with a serrate posterior margin, which extends posteriorly from the sterigma.

In addition to the two named species included in the group, two further species await description when adequate material is available; one is represented by a specimen collected at Bo in Sierra Leone, the other by a specimen from Jonga at 5500 ft on Mt Cameroun.

#### KEY TO SPECIES

- 1 Maximum width of non-hyaline terminal area at apex of fore wing 1 mm or less. ♂. Left arm of fulcrum longer than right. ♀. Serrate posterior margin of leaf-like process on sterigma four times width of base of its hollow stem . . . . . *acosmeta* (p. 194)
- Maximum width of non-hyaline terminal area at apex of fore wing 2–3 mm. ♂. Right arm of fulcrum longer than left. ♀. Serrate posterior margin of leaf-like process on sterigma twice width of base of hollow stem *pinheyi* (p. 195)

#### *Zamarada acosmeta* Prout

(Text-figs 320, 321; Pl. 69, figs 726, 727; Pl. 114, fig. 1036)

*Zamarada acosmeta* Prout, 1921: 157, text-fig. 16. Holotype ♀, BURUNDI (BMNH) [examined].

♂♀ (Pl. 114, fig. 1036). Wings almost entirely hyaline, weakly tinged with yellowish green in fresh specimens and sparsely striate with brownish grey; discal spots minute; costa of fore wing buff, striate with brownish grey. Non-hyaline terminal area very slender, not broader than 1 mm, very finely brownish orange, then brownish grey (pl. 5, C2, birch grey) to termen. Underside of non-hyaline terminal area uniformly brownish grey (pl. 5, E2–E3).

♂ genitalia (Text-figs 320, 321). Tenth tergite and sternite twisted through 180 degrees; triangular uncus situate ventrally, scobinate medial plate of gnathus dorsally. Fulcrum bifid, each arm spined apicad along its central core and each tipped with a stout spine, left arm longer than right.

♀ genitalia (Pl. 69, figs 726, 727). Serrate posterior margin of leaf-like process on sterigma four times as wide as the base of its hollow stem. Operculum with a short, digitate process at one side anteriorly.

Measurements. Fore wing: ♂ 14–16 mm; ♀ 15.0–16.5 mm. Antennal pectinations: ♂ 12 ×, ♀ 3 × diameter of shaft.

Distinguished externally by colour and pattern; *unisona* in the *metrioscaphes*-group, the only species with which *acosmeta* might be confused, differs in lacking the slender, grey terminal band.

DISTRIBUTION. Malawi, Zambia, N.W. Angola, Zaire, Burundi, Uganda.

## MATERIAL EXAMINED.

*Zamarada acosmeta* Prout, holotype ♀, BURUNDI ('E. Tanganyika'): Urundi Dist., Upper Ruvuvu (Ruvubu) River, vii-viii. 1919 (T. A. Barns), Geometridae genitalia slide no. 5943, in BMNH.

MALAWI: Nkata Bay, xii. 1961, 1 ♂ (NMR, Bulawayo). ZAMBIA: Zambezi Rapids, Ikelenge, Mwinilunga, 24.i.1965, 1 ♂ (NMR, Bulawayo). ANGOLA: Lunda, District de Cacolo, Cucumbi, 1960 (*Mercier*), 1 ♀ (coll. Herbulot, Paris). ZAIRE ('Belgian Congo'): Katanga, Kolwezi, xi. 1963 (*V. Allard*), 1 ♂ (NMR, Bulawayo); Shinkolobwe, 13.xi.1930, 1 ♂ (BMNH); Elisabethville, v-vi, viii-xii (*C. Seydel*), 1 ♂, 1 ♀ (ZSBS, Munich), 6 ♂, 4 ♀ (BMNH), 8 ♂, 5 ♀ (MRAC, Tervuren). BURUNDI: Malagarassi Valley, Lumpungu R., vii. 1919 (T. A. Barns), 1 ♀ (*Zamarada acosmeta* Prout, paratype); Kitega, ii, vi-vii. 1952 (*Dr M. Fontaine*), 7 ♀ (MRAC, Tervuren). UGANDA: Kigezi, Mafuga Forest, 7500-8000 ft, vi. 1951 (T. H. E. Jackson), 3 ♂, 1 ♀ (BMNH); Toro, Kibale Forest, v. 1966 (R. H. Carcasson), 1 ♀ (NMK, Nairobi), 1 ♀ (BMNH); Bwamba, vi. 1956 (R. H. Carcasson), 1 ♂ (BMNH); Kampala, 4.v.1950 (*D. G. Sevastopulo*), 1 ♂ (BMNH).

*Zamarada pinheyi* Fletcher

(Text-figs 322, 323; Pl. 69, figs 728, 729; Pl. 114, fig. 1035)

*Zamarada pinheyi* Fletcher, 1956: 41, pl. 1, fig. 7. Holotype ♂, TANZANIA (BMNH) [examined].

♂ ♀ (Pl. 114, fig. 1035). Hyaline area of wings almost immaculate and finely edged distally with brown, costa of fore wing buff, costal edge suffused with a vinaceous-tinged brown proximally; discal spots minute. Non-hyaline terminal area 2-3 mm broad at apex of fore wing, slender elsewhere; greyish orange (pl. 6, B3) irrorate proximally with light brown (pl. 7, D4); cilia buff. Underside of non-hyaline terminal area brownish grey.

♂ genitalia (Text-figs 322, 323). Distinguished from *acosmeta* by the more slender, tapered valve and by the form of the fulcrum, in which the right arm is longer than the left and the central core of each is scobinate almost to the base.

♀ genitalia (Pl. 69, figs 728, 729). Distinguished from *acosmeta* by the more slender leaf-like process on the sterigma, the serrate posterior edge of which is twice as wide as the base of its hollow stem.

Measurements. Fore wing: ♂ 16-17 mm; ♀ 16.5-18.0 mm. Antennal pectinations ♂ 12 ×, ♀ 3 × diameter of shaft.

Externally distinct in colour and pattern; distinguished from *acosmeta* by the broader non-hyaline terminal area at the apex of the fore wing.

DISTRIBUTION. Tanzania.

## MATERIAL EXAMINED.

*Zamarada pinheyi* Fletcher, holotype ♂, TANZANIA ('Tanganyika'): E. Usambara Mts, Amani, ii. 1953 (*E. Pinhey*), Geometridae genitalia slide no. 6003, in BMNH.

TANZANIA: Amani, iv. 1952 (*C. Howard*), 1 ♀ (*Zamarada pinheyi* Fletcher, paratype; wrongly listed in original publication with holotype data); ibidem,

iv. 1955, 1 ♀ (NMK, Nairobi); ibidem, xi. 1965 (*R. H. Carcasson*), 1 ♂, 1 ♀ (NMK, Nairobi); ibidem, iv, viii, xi (*G. Pringle*), 1 ♂, 2 ♀ (BMNH).

### THE *DIONE*-GROUP

Externally similar in colour and pattern to species in the *xystra*-group.

Characterized in the male genitalia by the slender, tapered uncus and absence of ventral plate on the gnathus; by the form of the slender valve which bears long setae from the lobate apex of the ventral margin and by the form of its dorsal process which is angled through 90 degrees at mid-length. The aedeagus is tapered, with a small thorn-like projection at one-half. The fulcrum is slender with a scobinate apex.

The male hind tibia is similar to those found in the *metrioscaphes*-group, not dilate but enclosing a capsule of short hair-scales.

Only one species is known.

#### *Zamarada dione* (Prout MS) sp. n.

(Text-figs 324, 325; Pl. 118, fig. 1057)

♂ (Pl. 118, fig. 1057). Greenish tinged hyaline area striate with grey and finely edged distally with black; discal spot on hind wing minute and black, that on fore wing light grey outlined with black; costa of fore wing buff, irrorate with grey. Non-hyaline terminal area brown (pl. 7, E5, Somalis) varyingly irrorate with grey; dentate subterminal fascia a redder tone of brown. Underside of non-hyaline terminal area greyish brown, paler terminad.

♂ genitalia (Text-figs 324, 325). Juxta slender and bifurcate. Valve slender; ventral apex lobate bearing long setae; dorsal process right-angled at mid-length with small, setose projection near base. Coremata buff.

♀ unknown.

Measurements. Fore wing: ♂ 19-20 mm. Antennal pectinations: ♂ 5 × diameter of shaft.

Similar in colour and pattern to species in the *xystra*-group and to *rupta* sp. n. in the *principis*-group, but males may be distinguished by the simple hind tibia. In the male genitalia the form of the valve is diagnostic.

DISTRIBUTION. Zaire, Gabon.

Holotype ♂, ZAIRE ('Belgian Congo'): Middle Lowa Valley, Nr Walikali, 3-4000 ft, forest, ii. 1924, wet season (*T. A. Barns*), Geometridae genitalia slide no. 6431, in BMNH.

Paratypes. ZAIRE ('Belgian Congo'): holotype data, 1 ♂; W. Kivu, South Lowa Dist., Lowowo Valley, 4000 ft, mountain forest, iii. 1924, wet season (*T. A. Barns*), 1 ♂ (both BMNH). GABON: Belinga, Camp Central, 700 m, 29.v.1963, 1 ♂; Belinga, Piste de Mwadi, 800 m, 20.iii.1963, 1 ♂; Belinga, N. Crête Sud, 1000 m, 19.iii.1963, 1 ♂ (all *G. Bernardi*, in MBG, Paris).

THE *LABIFERA*-GROUP

The group is distinctively patterned in greyish yellow, brown and black with large, ovate discal spots and exceptionally long antennal pectinations in the male, measuring 17-18 × the diameter of the shaft.

Characterized in the male genitalia by the long, bluntly tipped uncus, one-fourth as long as the aedeagus, and by the form of the bifurcate valve, the apex of the dorsal margin being produced in lobate form, that of the ventral margin being produced and tapered. Arms of gnathus slender and fused medially, but without forming a ventral plate. Apical half of aedeagus blade-like and tapered, one-half of width of basal half. Apex of fulcrum a little broadened, spatulate and bearing a cluster of 9-12 stout spines. Vesica without cornutus.

The male hind tibia is similar to that found in the *metrioscaphes*-group.

## KEY TO SUBSPECIES

- 1 ♂. Valve bifurcate; ratio of greatest width of lobate extension of dorsal margin to its length from point of cleavage 3 : 7. ♀. Sclerotized transverse ridge on eighth sternum equal in width to sclerotized posterior part of corpus bursae. . . . . *labifera labifera* (p. 198)
- ♂. Ratio of greatest width of lobate extension of dorsal margin to its length from point of cleavage 5 : 7. ♀. Sclerotized transverse ridge on eighth sternum one and one-half times as wide as sclerotized posterior part of corpus bursae. . . . . *labifera discata* (p. 198)

*Zamarada labifera* Prout

(Text-figs 326-328; Pl. 70, figs 730-733; Pl. 115, figs 1037, 1038)

*Zamarada labifera* Prout, 1915 : 342.

♂ ♀ (Pl. 115, figs 1037, 1038). Hyaline area of wings lightly striate with brown and finely edged distally with light brown and then silvery grey; costa of fore wing light buff sparsely irrorate with brown; discal spots large and ovate, that on fore wing buff outlined with light brown, that on hind wing silvery grey outlined with dark brown. Non-hyaline terminal area of each wing greyish yellow; dentate subterminal fascia glossy light buff; fore wing suffused with light brown proximad of subterminal fascia and striate and suffused with black, as illustrated; the black striation and suffusion is strongly marked in the male, weakly marked in the female. Underside of non-hyaline terminal area dark brown proximally, buff distally; the dark brown extends to the termen in the discal and tornal areas of the fore wing.

♂ genitalia (Text-figs 326-328). Valve bifurcate; apex of ventral margin tapered, that of dorsal margin lobate; dorsal process with a triangular, setose projection near base.

♀ genitalia (Pl. 70, figs 730-733). Lamella antevaginalis asymmetrical with a strongly developed, triangular plate at right side and a small one at left side. Corpus bursae sclerotized in posterior fourth. Eighth sternum with transverse sclerotized ridge medially, fused with sterigma.

Measurements. Fore wing: ♂ 18-20 mm, ♀ 16-19 mm. Antennal pectinations: ♂ 17-18 ×, ♀ 5.0-6.5 × diameter of shaft.

Distinct in colour and pattern and in the exceptionally long pectinations of the male antennae.



DISTRIBUTION. W. Africa, Guinea to Cameroun, Zaire, Zambia, Tanzania.

Two subspecies are recognized, distinguished by modifications in the genitalia of both sexes.

***Zamarada labifera labifera* Prout**

(Text-figs 326, 327; Pl. 70, figs 730, 731; Pl. 115, fig. 1037)

*Zamarada labifera* Prout, 1915 : 342. Holotype ♂, CAMEROUN (BMNH) [examined].

♂ genitalia (Text-figs 326, 327). Spatulate and lobate extension of dorsal margin of valve only slightly dilate at apex; ratio of greatest width of extension to its length from point of cleavage 3 : 7.

♀ genitalia (Pl. 70, figs 730, 731). Sclerotized transverse ridge on eighth sternum equal in width to sclerotized part of corpus bursae, which is pyriform in shape.

Measurements. Fore wing: ♂ 18–20 mm; ♀ 16–18 mm. Antennal pectinations: ♂ 17 ×, ♀ 5 × diameter of shaft.

DISTRIBUTION. Guinea, Sierra Leone, Ivory Coast, Nigeria, Cameroun, Zaire, Zambia, Tanzania.

MATERIAL EXAMINED.

*Zamarada labifera* Prout, holotype ♂, CAMEROUN: Bitje, Ja River, smaller rains, iv–v. 1907 (G. L. Bates), Geometridae genitalia slide no. 1463, in BMNH.

GUINEA: Beyla (*Dr Mir. Mrázek*), 1 ♀ (MM, Brno). SIERRA LEONE: Freetown, x–xi. 1968 (*D. F. Owen*) 1 ♂, 1 ♀. IVORY COAST: Bingerville, vi. 1915 (*G. Melou*), 1 ♂ 1 ♀. NIGERIA: Zaria, Samaru, 15.viii.1968 (*J. Deeming*), 1 ♂; River Niger, Ogruga, 1 ♀; Jos, vi. 1960 (*J. Boorman*), 1 ♀. ZAIRE ('Belgian Congo'): Yakusu (*K. Smith*), 1 ♂; L. Kivu Dist., 15.vi.1950 (*H. B. D. Kettlewell*), 1 ♀. ZAMBIA: Mwinilunga, ii, v, 4 ♂ (NMR Bulawayo). TANZANIA: Mikindani, i–v. 1897 (*Reimer*), 1 ♀.

***Zamarada labifera discata* subsp. n.**

(Text-fig. 328; Pl. 70, figs 732, 733; Pl. 115, fig. 1038)

Distinguished from the nominate subspecies in the male by the narrower apex to the ventral margin and by the greatly dilate, spatulate, disc-like apex of the dorsal margin of the valve; ratio of greatest width of dorsal extension to its length from point of cleavage, 5 : 7 (Text-fig. 328).

♀ genitalia (Pl. 70, figs 732, 733). Distinguished by the broader sclerotized, transverse ridge on the eighth sternum, which is one and one-half times as broad as the sclerotized posterior part of the corpus bursae; the corpus bursae is long and slender, differently shaped from that of the nominate subspecies.

Measurements. Fore wing: ♂ 20 mm; ♀ 18.5–19.0 mm. Antennal pectinations: ♂ 18 ×, ♀ 6.5 × diameter of shaft.

DISTRIBUTION. N.E. Tanzania, Amani.

Holotype ♂, TANZANIA ('Tanganyika'): Amani (*G. Pringle*), Geometridae genitalia slide no. 7657, in BMNH.

Paratypes. TANZANIA: Amani, v. 1962 (G. Pringle), 1 ♀; ibidem, xii. 1962, 1 ♂; ibidem (R. H. Carcasson), xi. 1965, 1 ♀.

### THE *CYDIPPE*-GROUP

A group of species closely similar in colour and pattern to many included in the *excavata* and *protrusa*-groups, with hyaline areas tinged with bright green, almost devoid of dark striation and having minute discal dots; the non-hyaline terminal area is deeply excavate, almost to the termen between veins  $M_3$  and  $Cu_{1b}$  on each wing.

Characterized in the male genitalia by the presence of short, stout setae on the apical fourth and long, stiff setae on the weakly dilate basal fourth of the dorsal process of the valve; by the very long fulcrum, at least one and three-fourths as long as the aedeagus, which is curved through 90–180 degrees and finely scobinate at apex; and by the asymmetrical valves.

The apical two-thirds of the uncus is of even width to the narrowly rounded tip. The arms of the gnathus fuse to form a shallow, weakly sclerotized and scobinate ventral plate, narrowly rounded at tip.

The male hind tibia is dilate, enclosing a longitudinal tuft of long white hair-scales.

Two named species are included in the group, *cydippe* Herbulot and *adumbrata* sp. n.; two further species, one from Amani in Tanzania and one from the Shimba Hills in E. Kenya, await description when adequate material is available.

### KEY TO SPECIES

- 1 Right valve with apex of ventral margin produced in angular form, extending beyond level of rounded apex of dorsal margin. Fulcrum scobinate at apex and tipped with a stout spine . . . . . *adumbrata* (p. 200)
- Right valve with boldly rounded apex. Fulcrum scobinate at apex, but not tipped with a stout spine . . . . . *cydippe* (p. 199)

### *Zamarada cydippe* Herbulot

(Text-figs 329, 330; Pl. 71, figs 735, 736; Pl. 118, fig. 1062)

*Zamarada cydippe* Herbulot, 1954 : 329, pl. 1, fig. 14, text-fig. 16. Holotype ♂, GUINEA (MNHN, Paris) [examined].

♂ ♀ (Pl. 118, fig. 1062). Hyaline area of wings green, as in *dyscapna* and *hero* in the *excavata*-group, finely edged distally with pale yellow, then with brown; discal spots minute, dark grey; costa of fore wing yellow, striate with grey. Non-hyaline terminal area brownish grey (pl. 7, C2), vinaceous tinged in oblique light; dentate subterminal fascia brown (pl. 7, E7) finely edged distally with glossy buff; fascia broadly and strongly marked in apical half of fore wing; cilia chequered greyish buff and greyish brown. Underside of non-hyaline terminal area brown (pl. 6, E5).

♂ genitalia (Text-figs 329, 330). Valves asymmetrical; apex of right valve boldly rounded. Tip of fulcrum scobinate, but without stout spine at tip.

♀ genitalia (Pl. 71, figs 735, 736). Posterior margin of lamella antevaginalis bilobate,

anterior margin fused with and whole process overlaid by a sclerotized plate, which is irregularly serrate along its posterior margin.

Measurements. Fore wing: ♂ 14–16 mm; ♀ 13–15 mm. Antennal pectinations: ♂ 12 ×, ♀ 6 × diameter of shaft.

Distinguished from species in the *excavata*-group with similarly coloured green hyaline areas on the wings by the shape of the excavation and the colour of the non-hyaline terminal areas; males may be further distinguished by the presence of white hair tufts on the hind tibiae.

Most examples of *cydippe* may be distinguished externally from the closely related *adumbrata*, with which it occurs, by the darker coloured non-hyaline terminal area and its darker subterminal fascia; distinguished from it structurally in the male genitalia by the boldly rounded apex of the right valve and by the tip of the fulcrum, which lacks the stout terminal spine of that species; distinguished in the female genitalia by the symmetrical sterigma.

DISTRIBUTION. W. Africa, Guinea to Gabon, Zaire, Uganda, Tanzania.

#### MATERIAL EXAMINED.

*Zamarada cydippe* Herbulot, holotype ♂, GUINEA: Mt Nimba, viii. 1951 (*M. Lamotte & R. Roy*), in MNHN, Paris.

GUINEA: Beyla (*Dr Mir. Mrázek*), 1 ♂, 1 ♀ (MM, Brno); Massadou, near Macenta, 1600 ft, 13–17.v.1926 (*C. L. Collenette*), 1 ♂; Macenta, 2000 ft, v. 1926 (*C. L. Collenette*), 3 ♀ (all BMNH). SIERRA LEONE (*A. B. Frere*), 1 ♀. IVORY COAST: Bingerville, vi, viii, xi (*G. Melou*), 8 ♂, 4 ♀ (all BMNH); Yapo-Sud, 22 km S.S.E. of Agboville, 12–18.iv.1969 (*C. Herbulot*), 1 ♀ (coll. Herbulot, Paris). GHANA: Takwa (*R. E. James*), 1 ♀. CAMEROUN: N'Kongsamba, 5.iv.1958 (*P. Darge*), 1 ♀; 8 km N. d'Edea, 7.iv.1970 (*C. Herbulot*), 1 ♀; Yaoundé, 15.iii.1958 (*P. Darge*), 1 ♀; N'Kolbisson, près Yaoundé, 5.iv.1958 (*P. Darge*), 1 ♂; M'Balmayo, 25.viii.1967 (*P. Darge*), 1 ♂; ibidem, 11.x.1971, 1 ♂ (all coll. Herbulot, Paris); Efulen, v, x (*H. L. Weber*), 4 ♂ (CM, Pittsburgh); Epulan, 17.iv.1926 (*G. Schwab*), 1 ♂; Bitje, Ja River, 2000 ft, x–xi. 1912, 1 ♂ (both BMNH). GABON: Belinga, Camp Central, Piste de Mwadi, 800 m, 20.iii.1963, 1 ♂; Makokou, 500 m, 7.v.1963, 1 ♂ (both *G. Bernardi*, in MGB, Paris); Mouila, 7.x.1964 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris). ZAIRE ('Belgian Congo'): Lusambo, 10.ix.1950 (*Dr M. Fontaine*), 1 ♂ (MRAC, Tervuren). UGANDA: Kamengo (*G. W. Jeffery*), 1 ♂; Kampala, 3.v.1955 (*D. G. Sevastopulo*), 1 ♀; Mukono, 22.v.1938, 1 ♂ (all BMNH); Entebbe, Zika Forest, v. 1961, 1 ♂ (NMR, Bulawayo). TANZANIA: Bagamoyo, vi. 1892, 1 ♂ (MNHU, Berlin).

#### *Zamarada adumbrata* sp. n.

(Text-figs 331, 332; Pl. 71, figs 734, 737, 738; Pl. 118, fig. 1064)

♂ ♀ (Pl. 118, fig. 1064). Externally closely similar to *cydippe*; most examples may be distinguished by the paler non-hyaline terminal area, greyish orange (pl. 6, B3) distad of the subterminal fascia, orange-grey (pl. 6, B2) proximad of it; the subterminal fascia is brownish orange (pl. 6, C7).

Two male examples from S. Malawi, one from Zomba and one from Luchenyia, have very narrow, grey patterned terminal areas to the wings and in this respect are closely similar to *aclea* and *angustumargo* in the *bathyscaphes*-group, but are distinguished by the absence of striation and the presence of a minute discal spot in the hyaline area of each wing.

♂ genitalia (Text-figs 331, 332). Differs from closely similar *cydippe* in the form of the right valve, in which the ventral margin is produced in angular form and extends beyond the level of the rounded apex of the dorsal margin, and in the fulcrum, which is tipped with a stout spine. The extent to which the ventral margin of the right valve is produced varies and in many examples the valves are almost symmetrical.

♀ genitalia (Pl. 71, figs 734, 737, 738). Distinguished from *cydippe* by the form of the asymmetrical sterigma; the lamella antevaginalis is differently shaped and is situate at the right side; its posterior margin is not bilobate. In some examples parallel, diagonal, sclerotized ridges are developed at the left side (Pl. 71, fig. 738).

Measurements. Fore wing: ♂ 15–18 mm; ♀ 14–16 mm. Antennal pectinations: ♂ 15 × ♀ 7 × diameter of shaft.

DISTRIBUTION. W. Africa, Guinea to Angola, Zaire, Uganda, Malawi.

Holotype ♂, ANGOLA: Amboim District, Fazenda Congulu, 7–800 m, 7–11.iv.1934 (*Dr K. Jordan*), Geometridae genitalia slide no. 7837, in BMNH.

Paratypes. GUINEA: Beyla (*Dr Mir. Mrázek*), 6 ♂ (MM, Brno); Macenta, 2000 ft, 2–21.v.1926 (*C. L. Collenette*), 3 ♀ (BMNH). SIERRA LEONE: (*A. B. Frere*), 1 ♀; Freetown, 1898 (*A. Mocquerys*), 1 ♂; ibidem, 8–19.xi.1968 (*D. F. Owen*), 1 ♂ (all BMNH). IVORY COAST: 2 ♀ (BMNH); Lamto, 36 km N.N.W. of Tiassalé, 20–23.iv.1969 (*C. Herbulot*), 1 ♂ (coll. Herbulot, Paris). GHANA: N. Territories, Kete-Krachi (*A. W. Cardinall*), 1 ♂ (BMNH). NIGERIA: 3 ♀ (UM, Oxford). CAMEROUN: Bitje, Ja River, 2000 ft, iv–v. 1909, wet season (*G. L. Bates*), 1 ♂; ibidem, dry season, vi–vii. 1909, 1 ♂; ibidem, x, wet season, 1 ♀ (all BMNH). GABON: Franceville, 26.i.1964 (*P. Darge*), 1 ♂; ibidem, 22.vii.1963, 1 ♀ (both coll. Herbulot, Paris). ANGOLA: holotype data, 7–22.iv.1934, 4 ♂, 3 ♀. ZAIRE ('Belgian Congo'): Sankaru, Katoko-Kombe, 2.v.1952 (*Dr M. Fontaine*), 1 ♀ (MRAC, Tervuren); Upper Uele District, Dungu, iv, 1 ♂ (BMNH); Paulis, 25.vi.1960 (*Dr M. Fontaine*), 1 ♀ (MRAC, Tervuren). CENTRAL AFRICAN REPUBLIC: Bimbo, 24.iv.1970 (*C. Lemaire*), 1 ♂, 1 ♀ (coll. Herbulot, Paris). UGANDA: Bwamba, v. 1958 (*R. H. Carcasson*), 1 ♀ (BMNH); Toro, Kibale Forest, v. 1966 (*R. H. Carcasson*), 1 ♀ (NMK, Nairobi); Masaka, Sango Bay, Katera, x. 1960 (*R. H. Carcasson*), 1 ♂ (BMNH), 1 ♀ (NMK, Nairobi); Entebbe, iii. 1961 (*N. Mitton*), 1 ♀ (BMNH); Entebbe, v. 1961 (*T. H. E. Jackson*), 1 ♂ (NMK, Nairobi); Entebbe, v. 1961, 1 ♂ (BMNH), 3 ♂ (NMR, Bulawayo).

Specimens associated with *adumbrata*, but excluded from the type-series: MALAWI: Mt Mlanje, 29.i.1913 (*S. A. Neave*), 1 ♂; S.W. of Lake Chilwa, 8.i.1914 (*S. A. Neave*), 1 ♂; Zomba, viii. 1925 (*H. Barlow*), 1 ♂; Luchenza, Magunda Estate (*F. Nisbet*), 1 ♂ (all BMNH).

#### THE *ACROCHRA*-GROUP

Characterized in the male genitalia by the form of the valve; by the presence of a short, longitudinal, medial ridge and by the strongly sclerotized, rounded,



spatulate apex, incurved through 90 degrees towards the uncus. The dorsal process is dilate and setose in its basal fourth, the dilation smooth or irregular in outline, but never digitate in form. The fulcrum is slender, never broader than one-half of the greatest width of the aedeagus and, except in *auratisquama*, about twice as long as the aedeagus. The uncus is long, slender and tapered. The ventral plate of the gnathus is weakly sclerotized, broad, deep and minutely scobinate. The aedeagus is short and stout, with or without coarse scobination on one surface. Vesica without cornutus.

The male hind tibia is dilate, enclosing a dense tuft of long hair-scales.

In the female genitalia the posterior margin of the lamella antevaginalis is irregularly serrate, as in the *metrioscaphes*-group, but usually more strongly developed on the right side; lamella postvaginalis also similar to those of the *metrioscaphes*-group, medially rugose with a series of closely adpressed, concentric folds.

#### KEY TO SPECIES

- |   |                                                                                                                                                                                                                                                                                                                                                                         |                              |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 1 | Aedeagus coarsely scobinate on one surface in apical third . . . . .                                                                                                                                                                                                                                                                                                    | 2                            |
| - | Aedeagus smooth . . . . .                                                                                                                                                                                                                                                                                                                                               | 3                            |
| 2 | (1) Fulcrum subequal in length to aedeagus . . . . .                                                                                                                                                                                                                                                                                                                    | <i>auratisquama</i> (p. 206) |
|   | Fulcrum one and three-fourths as long as aedeagus . . . . .                                                                                                                                                                                                                                                                                                             | <i>acrochra</i> (p. 205)     |
| 3 | (1) Non-hyaline terminal area uniformly fawn coloured, without subterminal fascia. Distal margin of hyaline area smoothly curved without marked excavation of terminal area between veins $M_3$ and $Cu_{1b}$ (Pl. 115, fig. 1044)                                                                                                                                      | <i>clenchi</i> (p. 204)      |
| - | Non-hyaline terminal area not so coloured and deeply excavate between veins $M_3$ and $Cu_{1b}$ ; subterminal fascia present . . . . .                                                                                                                                                                                                                                  | 4                            |
| 4 | (3) Hyaline area of wings without discal spots. Non-hyaline terminal area deeply excavate on each wing between veins $M_3$ and $Cu_{1b}$ , the hyaline extending almost to termen on hind wing (Pl. 115, fig. 1043). Greatest width of dilate hind tibia equal to one-fifth of its length. Basal projection from dorsal process of valve irregular in outline . . . . . | <i>enippe</i> (p. 203)       |
| - | Slender, grey discal spots present on each wing. Non-hyaline terminal area excavate to one-half of its width between veins $M_3$ and $Cu_{1b}$ . Greatest width of dilate hind tibia one-half of its length. Basal projection from dorsal process of valve smooth in outline . . . . .                                                                                  | <i>dilata</i> (p. 202)       |

#### *Zamarada dilata* sp. n.

(Text-figs 333, 334; Pl. 72, figs 739, 740; Pl. 115, fig. 1042)

♂ ♀ (Pl. 115, fig. 1042). Hyaline area of wings tinged with yellow and finely edged distally with dark brown; costa of fore wing buff irrorate with dark grey medially, densely with pearly grey at base; posterior margin of each wing irrorate with pearly grey; discocellulars slenderly pearly grey. Non-hyaline terminal area of each wing brownish orange (pl. 7, C5) to light brown (pl. 7, D5) sparsely irrorate with dark brown; dentate subterminal fascia broken, dark brown edged distally with a few glossy buff scales; cilia chequered dull buff and grey. Underside of non-hyaline terminal area of each wing dark brown proximally, markedly paler terminally; apical area of fore wing light buff sparsely irrorate with brown; cilia chequered brown and grey.

Male hind tibia grossly dilate, one-half as broad as long, enclosing a dense tuft of light buff hair-scales.

♂ genitalia (Text-figs 333, 334). Aedeagus smooth and tapered to narrowly rounded apex. Fulcrum slender and tapered to shortly spined apex, two and one-third times as long as aedeagus.

♀ genitalia (Pl. 72, figs 739, 740). Lamella antevaginalis sclerotized and asymmetrical, more strongly developed at right side; posterior margin irregularly serrate with a U-shaped excavation at left side. Posterior margin of lamella postvaginalis medially rugose. Corpus bursae membranous.

Measurements. Fore wing: ♂ 16–20 mm, ♀ 17–19 mm. Antennal pectinations: ♂ 8 ×, ♀ 4 × diameter of shaft.

Closely similar to *acrochra* Prout in colour and pattern; on average greater in wing-span, the hyaline area markedly tinged with yellow, discal marks more slender and less diffuse and the colour of the non-hyaline terminal area more of an orange-brown. Structurally the male may be readily distinguished by the grossly dilate hind tibia, its width equal to one-half its length; in the genitalia by the form of the valve and by the absence of coarse scobination on the slender aedeagus; the female genitalia differ in the broader, lateral projections from the posterior margin of the lamella antevaginalis, these being acicular in *acrochra*.

DISTRIBUTION. Cameroun, Gabon, Zaïre.

Holotype ♂, CAMEROUN ('Kamerun'): Efulen, 30.iv.1913 (*H. L. Weber*), Ac. 4938, in CM, Pittsburgh.

Paratypes. CAMEROUN: Ndongue, 10 km S.S.W. of N'Kongsamba, 650 m, 17.x.1971 (*P. Darge*), 1 ♂; Ewonda (Route Buea-VHF transmitter on Mt Cameroun), 900 m, 23–27.x.1971 (*P. Darge*), 1 ♂; M'Balmayo, Ecole forestière, 11.ix.1971 (*P. Darge*), 3 ♂ (all coll. Herbulot, Paris); Efulen, iv–vi (*H. L. Weber*), 11 ♂, 3 ♀; ibidem, viii–x, 2 ♂, 2 ♀; ibidem, xii, 4 ♂, 1 ♀; (all CM, Pittsburgh); Epulan, iv–v. 1926 (*G. Schwab*), 2 ♂; Lolodorf, 1894–1895 (*L. Conradt*), 6 ♂ (all BMNH). GABON: Franceville, 26.i.1964 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris); Savanes de Mwadi, près du Iézé, 26.iii.1963 (*G. Bernardi*), 2 ♂; ibidem, 1.iv.1963, 3 ♂, 1 ♀ (all MBG, Paris). ZAIRE ('Belgian Congo'): Equateur, Ikela, Loile River, iv. 1959 (*R. H. Carcasson*), 1 ♀ (BMNH); Kasai, Lodja, iii. 1959 (*R. H. Carcasson*), 1 ♂ (NMK, Nairobi); Sankaru, Katako-Kombe, 16.iii.1952 (*Dr M. Fontaine*), 1 ♂; ibidem, 23.iii.1952, 1 ♂; 15.vii.1952, 1 ♀; 9.viii.1952, 1 ♂; Lusambo, 19.vi.1949 (*Dr M. Fontaine*), 1 ♂ (all MRAC, Tervuren); W. Kivu, nr Masisi, Upper Lowa Valley, 5–6000 ft, forest and long grass, ii. 1924, wet season (*T. A. Barns*), 1 ♂ (BMNH).

### *Zamarada enippe* Prout

(Text-figs 335, 336; Pl. 115, fig. 1043)

*Zamarada enippe* Prout, 1921 : 155, pl. 18, fig. 24. Holotype ♂, ZAIRE (BMNH) [examined].

♂ (Pl. 115, fig. 1043). Hyaline area of wings very weakly tinged with yellow, finely edged distally with black and boldly and smoothly excurved terminad between veins  $M_3$  and  $Cu_{1b}$ , extending almost to the termen on the hind wing; costa of fore wing buff irrorate with dark grey medially and densely with pearl-grey at base, the pearl-grey irroration extending along

the posterior margin of the wing; discal spots absent. Non-hyaline terminal area of each wing light brown (pl. 7, D4) tinged with purplish grey; subterminal fascia dentate and black, finely edged distally with sparse glossy buff scales, broken between veins. Underside of non-hyaline terminal area uniformly greyish brown.

Male hind tibia dilate with a dense tuft of dark brown hair-scales, the tuft almost as long as the tibia.

♂ genitalia (Text-figs 335, 336). Closely similar to those of *dilata*, differing in the broader dilation of the dorsal process of the valve near its base and its irregular rather than smooth outline.

♀ unknown.

Measurements. Fore wing: ♂ 18–19 mm. Antennal pectinations: ♂ 7 × diameter of shaft.

Distinguished externally from the closely related *dilata* by the broader and deeper extension of the clearer hyaline area terminad between veins  $M_3$  and  $Cu_{1b}$ , by the absence of any discal marking, by the colour of the upperside of the non-hyaline terminal area of each wing and by the uniformly greyish brown colour of its underside. Distinguished further by the markedly less dilate hind tibia in the male and its longer, darker hair tuft.

DISTRIBUTION. Zaire.

#### MATERIAL EXAMINED.

*Zamarada enippe* Prout, holotype ♂, ZAIRE ('Belgian Congo'): Congo River, Kinshasa, v. 1920 (*T. A. Barns*), Geometridae genitalia slide no. 3654, in BMNH.

ZAIRE ('Belgian Congo'): nr Walikali, Middle Lowa Valley, 3–4000 ft, ii. 1924, wet season (*T. A. Barns*), 1 ♂; nr Masisi, Upper Lowa Valley, 5–6000 ft, forest and long grass, ii. 1924 (*T. A. Barns*), 1 ♂ (both BMNH).

#### *Zamarada clenchi* sp. n.

(Text-figs 337, 338; Pl. 72, figs 741, 742; Pl. 115, fig. 1044)

♂ ♀ (Pl. 115, fig. 1044). Hyaline area of wings tinged with light buff, distal margin finely light brown, evenly curved from costa to posterior margin on each wing; costa and posterior margin of fore wing light buff, the former irrorate with greyish brown; discocellulars finely and sparsely light buff. Non-hyaline terminal area of each wing fawn colour sparsely irrorate with light brown; subterminal fascia not marked; cilia fawn. Underside of non-hyaline terminal area brown, paler terminad; apical area of fore wing light buff; terminal interneural spots brown.

The male hind tibia is dilate enclosing a dense tuft of white hair-scales, the tuft almost as long as the tibia.

♂ genitalia (Text-figs 337, 338). Closely similar to those of *dilata* and *enippe*, differing in the dilation of the basal part of the dorsal process of the valve; in *clenchi* it is more extensive and has a crenulate perimeter, bearing long setae as in *enippe*.

♀ genitalia (Pl. 72, figs 741, 742). Closely similar to those of *dilata*, but differing in the form of the serrate posterior margin of the lamella antevaginalis; in *dilata* there is a U-shaped excavation at the left side; in *clenchi* the left-hand three-fourths extends transversely without such an excavation.

Measurements. Fore wing: ♂ ♀ 17–19 mm. Antennal pectinations: ♂ 7 ×, ♀ 5 × diameter of shaft.

Externally one of the most distinctive species in the genus, the colour and pattern being diagnostic.

It is with pleasure that I name this species in honour of Dr Harry K. Clench of the Carnegie Museum in Pittsburgh in token acknowledgement of his generous help, with the loan of very rich material from Cameroun and his placing at my disposal a key to the West African species which he had prepared.

DISTRIBUTION. Cameroun, Gabon, Zaire, Uganda.

Holotype ♂, CAMEROUN ('Kamerun'): Efulen, 7.iv.1923 (*H. L. Weber*), in CM, Pittsburgh.

Paratypes. CAMEROUN: Massif du Manengouba, Piste Bakwat-Mwakoumel, 1240 m, 11-12.iv.1970, 1 ♂; Mont Kala, 18 km W. de Yaoundé, 1120 m, 20.iv.1972, 2 ♂, 1 ♀; N'Kolbisson, 7 km W. de Yaoundé, 700 m, 15-21.iv.1972, 12 ♂, 1 ♀ (all *C. Herbulot*, in coll. Herbulot, Paris); Nkoemvom près Ebolowa, 18.iv.1970 (*C. Lemaire*), 2 ♂; M'Balmayo, Ecole forestière, 11.iv.1970 (*P. Darge*), 1 ♂ (all coll. Herbulot, Paris); Efulen, 11-iv (*H. L. Weber*), 18 ♂; ibidem, x-xii, 3 ♂ (all CM, Pittsburgh); Epulan, iv-v (*G. Schwab*), 2 ♂ (BMNH). GABON: Makokou, 5.xi.1962, 1 ♂; Confluent Ivindo et Ié, 23.x.1963, 1 ♂; Savanes Mwadi, près du Iézé, 16.iii.1963, 1 ♂; Belinga, Grande Crête Sud, 900 m, 29.iii.1963, 1 ♂; Belinga, N. Crête Sud, 1000 m, 19.iii.1963, 2 ♂; ibidem, 29.iii.1963, 1 ♂ (all *G. Bernardi*, in MBG, Paris); Mouila, ix-x (*P. Darge*), 2 ♀ (coll. Herbulot, Paris). ZAIRE ('Belgian Congo'): Uele, Paulis, 25.vi.1956 (*Dr M. Fontaine*), 1 ♂ (MRAC, Tervuren). UGANDA: Bwamba, Toro, ix. 1961 (*N. Mitton*), 1 ♂ (NMK, Nairobi).

### *Zamarada acrochra* Prout

(Text-figs 339, 340; Pl. 73, figs 743, 744; Pl. 115, fig. 1041)

*Zamarada acrochra* Prout, 1928 : 70. Holotype ♂, SENEGAL (BMNH) [examined].

♂♀ (Pl. 115, fig. 1041). Closely similar to *dilata*, but slightly smaller in wing-span; hyaline area of wings almost colourless, lacking the distinct yellow tinge of that species; non-hyaline terminal area a more vinaceous brown (pl. 9, D4, reddish brown); discal spot on upperside of fore wing grey, usually more diffuse than in *dilata* and on underside dark brown, more heavily marked. Underside of non-hyaline terminal area dark brown, paler terminad, the paler area on each wing more evenly defined than in *dilata*, lacking the conspicuously contrasted pale apical area of that species.

Male hind tibia dilate, with tuft of long, buff hair-scales, tuft almost equal in length to tibia.

♂ genitalia (Text-figs 339, 340). Differ from those of *clenchi* in the shorter valve, the apex of which is broader and less boldly incurved towards the uncus; in the form of the aedeagus, which is broadly dilate medially with a curved ridge of short spines at one side and in the slightly shorter fulcrum, which is just less than twice as long as the aedeagus.

♀ genitalia (Pl. 73, figs 743, 744). Distinguished from *dilata* by the slender, acicular projections from each side of the posterior margin of the lamella antevaginalis.

Measurements. Fore wing: ♂♀ 14-18 mm. Antennal pectinations: ♂ 10 ×, ♀ 3 × diameter of shaft.

DISTRIBUTION. W. Africa, Senegal to Angola; Tanzania.



## MATERIAL EXAMINED.

*Zamarada acrochra* Prout, holotype ♂, SENEGAL: Sedhiou, 17-25.vii.1917 (*H. Castell*), Geometridae genitalia slide no. 6379, in BMNH.

SENEGAL: Sedhiou, 1917 (*H. Castell*), 1 ♀; ibidem, 5-12.vii.1917, 2 ♀ (all *Zamarada acrochra* Prout paratypes, in BMNH). GUINEA: Boffa (ex de Fleury), 1922, 1 ♀. SIERRA LEONE: Freetown, Mt Annol, vi. 1900 (*F. S. Penny*), 1 ♀; Freetown, vii. 1933 (*P. A. Buxton*), 1 ♀; ibidem, x-xii (*D. F. Owen*), 9 ♂, 3 ♀ (all BMNH). IVORY COAST: Yapo-Sud, 22 km S.S.E. of Agboville, 12-18.iv.1969 (*C. Herbulot*), 3 ♂, 6 ♀; Lamto, 36 km N.N.W. of Tiassalé, 20-23.iv.1969 (*C. Herbulot*), 6 ♂, 2 ♀ (all coll. Herbulot, Paris). GHANA: N. Territories, Kete-Krachi (*A. W. Cardinall*), 6 ♀; Kumasi (*H. Whiteside*), 2 ♀; Wassaw distr., 45 miles inland from Sekondi, 1 ♀; Nsaba, v. 1922 (*N. E. Bell*), 1 ♀ (all BMNH). NIGERIA: Lagos, 2 ♂, 3 ♀; Lagos, Olokemeji, iv. 1906 (*G. C. Dudgeon*), 1 ♂; Agoïe (Benin), 1884 (*Abbé Menager*), 1 ♂; Lokoja, R. Niger (*A. Cook*), 1 ♀; Abinsi, River Benue, 7.v.1912, 1 ♂; Ogruga, Niger, 1 ♂, 1 ♀; Degama, Niger (*Dr Ansorge*), 1 ♀. CAMEROUN: Lolodorf, 1894-1895 (*L. Conradt*), 2 ♀; ibidem, ix. 1930-i. 1931, 1 ♀ (all BMNH); Efulen, iii-vi, x, xii (*H. L. Weber*), 3 ♂, 8 ♀ (all CM, Pittsburgh); Epulan, 1.v.1926 (*G. Schwab*), 1 ♀ (BMNH). GABON: Wonga Wonghé, 12.ii.1967 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris). ANGOLA: Amboim district, Fazenda Congulu, 7-800 m, 7-11.iv.1934 (*Dr K. Jordan*), 1 ♀ (BMNH). TANZANIA: Kigoma, Mukuyu, xii. 1962, Japanese Primate Expedition, 1 ♂ (NMK, Nairobi).

*Zamarada auratisquama* Warren

(Text-figs 341, 342; Pl. 73, figs 745, 746; Pl. 118, fig. 1059)

*Zamarada auratisquama* Warren, 1897: 122. Holotype ♂, NIGERIA (BMNH) [examined].

♂ ♀ (Pl. 118, fig. 1059). Hyaline area of wings tinged with dark green and edged distally with two fasciae, the more proximal bright buff, the more distal brownish orange (pl. 6, C8) finely edged with silvery grey; costa of fore wing yellow irrorate with dark grey and brownish orange medially and with pearl grey basally; tegulae, posterior margin and slenderly marked discocellulars on fore wing pearl-grey. Subterminal fascia dentate and brown irrorate with black, strongly marked and finely edged distally with silvery grey; proximad of subterminal fascia non-hyaline area light brown, distad of it warm buff and grey. Underside of non-hyaline area light brown, distad of it warm buff and grey. Underside of non-hyaline terminal area dark brown proximally, paling to buff terminad, except in discal area of fore wing; apical area of fore wing clear buff; discocellulars of fore wing strongly but slenderly marked, dark brown.

Male hind tibia dilate with dense tuft of long, light buff hair-scales, the tuft almost as long as the tibia.

♂ genitalia (Text-figs 341, 342). Similar to those of *acrochra*, differing in the slightly longer valve and the dilation of its dorsal process near base; in the longer, less dilate aedeagus with its straight ridge of short spines and in the very short fulcrum, which is only one-half as long as the aedeagus.

♀ genitalia (Pl. 73, figs 745, 746). Posterior margin of lamella antevaginalis minutely serrate, shallowly excavate medially. Signum distinctively non-stellate, smooth-edged except for minute serrations anteriorly.

Measurements. Fore wing: ♂ 17.5-19.0 mm; ♀ 18-19 mm. Antennal pectinations: ♂ 7 ×, ♀ 3 × diameter of shaft.

A very beautiful and externally distinctive species. Structurally the form of the aedeagus and the short fulcrum in the male genitalia and the form of the lamella antevaginalis and non-stellate signum in the female genitalia are diagnostic.

DISTRIBUTION. Nigeria, Cameroun, Gabon, Zaïre.

MATERIAL EXAMINED.

*Zamarada auratisquama* Warren, holotype ♂, NIGERIA: Warri, Niger C.P., ii. 1896 (*Dr Roth*), Geometridae genitalia slide no. 6376, in BMNH.

CAMEROUN: Efulen, vi, x-xii (*H. L. Weber*), 4 ♂, 5 ♀ (CM, Pittsburgh). GABON: Lastourville, 12.xi.1957 (*P. C. Rougeot*), 1 ♂ (MNHN, Paris); Franceville, 21.ix.1963 (*P. Darge*), 1 ♀ (coll. Herbulot, Paris). CENTRAL AFRICAN REPUBLIC: Bangui, xii. 1968, 1 ♂ (coll. Herbulot, Paris). ZAIRE ('Belgian Congo'): Kivu, Kisenyi, v. 1935 (*van Saceghem*), 1 ♂ (BMNH).

THE *UNDIMARGINATA*-GROUP

Characterized in the male genitalia by the form of the valve, which is cleft apicad; ventral third very weakly sclerotized and tapered to setose apex; dorsal two-thirds strongly sclerotized and produced in arcuate form, curving towards uncus, the apical margin evenly serrate. Uncus bulbous in shape, dorsal surface densely clothed with short spines, apex produced ventrad. Aedeagus with short, digitate projection mediodorsally. Vesica with two groups of numerous spine-like cornuti.

In the female genitalia the posterior margin of the lamella antevaginalis is excavate medially; ventrad of it is a sclerotized plate with a minutely serrate posterior margin. Lamella postvaginalis produced medio-posteriorly in form of a sclerotized tube, tapering and weakening to become membranous and retractile.

In the male the femur is fringed with buff and long, dark grey hair-scales on its lateral surfaces and with short, very broad, light buff scales on its inner surface; tibia dark grey and grossly dilate enclosing a dense tuft of hair-scales.

KEY TO SPECIES

- 1 Hyaline area of wings white, without discal spots. Non-hyaline terminal area black . . . . . *undimarginata* (p. 209)
- Hyaline area of wings tinged with greyish yellow; discal spot large on fore wing, slender on hind wing. Non-hyaline terminal area brownish orange . . . . . *corroborata* (p. 207)

*Zamarada corroborata* Herbulot

(Text-figs 343, 344; Pl. 77, figs 763, 764; Pl. 116, fig. 1047)

[*Comibaena reflexaria* Walker, [1863] : 1565, paralectotype. Misidentification.]

*Zamarada corroborata* Herbulot, 1954 : 328, pl. 1, fig. 13, text-fig. 15. Holotype ♂, GUINEA (MNHN, Paris) [examined].

♂ ♀ (Pl. 116, fig. 1047). Hyaline area of wings weakly tinged with greyish yellow and finely edged distally with black. Fore wing: costa deep buff, irrorate with iron-grey; discal spot large, buff densely irrorate with brownish grey. Hind wing: discocellulars very slenderly buff, occasionally with a grey dot at point of fold  $M_2$ ; costa and subcostal vein brownish grey. Non-hyaline terminal area of each wing brownish orange (pl. 6, C6); subterminal fascia dentate and broken, brown (pl. 6, E6); proximad of subterminal fascia non-hyaline area suffused with brownish grey (pl. 6, E2).

In some examples the distal penetration of the hyaline area is shallow; in others the non-hyaline terminal area is grey with a correspondingly darker grey, dentate subterminal fascia.

Underside of non-hyaline terminal area uniformly brown.

♂ genitalia (Text-figs 343, 344). Membranous part of valve acutely angled at point of fusion with strongly sclerotized dorsal margin. Aedeagus tapered. Fulcrum extending beyond tip of aedeagus.

♀ genitalia (Pl. 77, figs 763, 764). See under species-group heading. Posterior fifth of corpus bursae minutely scobinate.

Measurements. Fore wing: ♂ 17–21 mm; ♀ 16–19 mm. Antennal pectinations: ♂ 8 ×, ♀ 2 × diameter of shaft.

Externally similar to *subincoloris* Gaede in the *principis*-group, but with slightly greater wing-span and a less yellow hyaline area; males of *corroborata* may be separated readily by the presence of the grossly dilate, black hind tibia. The genitalia of both sexes of *corroborata* and *subincoloris* are sufficiently distinctive to be distinguished even in the dry state.

DISTRIBUTION. W. Africa, Guinea to Cameroun, Zaire.

#### MATERIAL EXAMINED.

*Comibaena reflexaria* Walker, paralectotype ♂, Sine loc. [18]43–58 [pres. by Edward Doubleday], in BMNH, misidentification. *Zamarada corroborata* Herbulot, holotype ♂, GUINEA: Mt Nimba, 550 m, viii. 1951 (*M. Lamotte & R. Roy*), in MNHN, Paris.

GUINEA: Macenta, 2000 ft, v. 1926 (*C. L. Collenette*), 1 ♂ (BMNH), Beyla (*Dr Mir. Mrázek*), 1 ♂, 1 ♀ (MM, Brno). SIERRA LEONE: Njala, 29.viii.1930 (*E. Hargreaves*), 1 ♂; Freetown, x–xii. 1968 (*D. F. Owen*), 7 ♂, 4 ♀; Bo, vi. 1969 (*R. Revell*), 4 ♂ (all BMNH). LIBERIA: Nimba, Grassfield, vi–viii. 1967 (*A. Forbes-Watson*), 3 ♂, (NMK, Nairobi); Marshall Terr., Harbel, ii, x. 1956 (*R. M. Fox*), 2 ♂ (CM, Pittsburgh). IVORY COAST: Bingerville (*G. Melou*), 4 ♂; ibidem, v, vi, viii, ix, 7 ♂, 2 ♀ (BMNH); Yapo-Sud, 22 km S.S.E. of Agboville, 12–18.iv.1969, 20 ♂, 7 ♀; Lamto, 36 km N.N.W. of Tiassalé, 20–23.iv.1969, 1 ♀ (all *C. Herbulot*, in coll. Herbulot, Paris). GHANA: Ashanti, Juaso (*G. H. Gibbs*), 1 ♂; Kumasi (*H. Whiteside*), 2 ♂, 1 ♀. NIGERIA: Ikom, ii. 1957 (*J. Boorman*), 2 ♂; Ilesha (*L. E. H. Humfrey*), 1 ♂; Warri, iv, ix. 1897 (*Dr Roth*), 1 ♂, 1 ♀ (all BMNH). CAMEROUN: Manengouba, 1040 m, 20.x.1971 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris); Johann-Albrechts Höhe (*L. Conradt*), 1 ♂; Lolodorf, 1894–95 (*L. Conradt*), 2 ♂; ibidem, 11.vii.1895, 1 ♂ (all BMNH); Efulen, ii–vii, viii–ix, xi–xii (*H. L. Weber*), 19 ♂, 3 ♀ (CM, Pittsburgh). ZAIRE ('Belgian Congo'): Equateur, Besongo, viii. 1940 (*Rév. P. Hulstaert*), 1 ♀; Equateur, Isaka, 19.ix.1940 (*Rév. P. Hulstaert*), 1 ♂ (both MRAC, Tervuren).

*Zamarada undimarginata* Warren

(Text-figs 345, 346; Pl. 119, fig. 1065)

*Zamarada undimarginata* Warren, 1897 : 123. Holotype ♂, NIGERIA (BMNH) [examined].

♂♀ (Pl. 119, fig. 1065). Hyaline area of wings white. Costa of fore wing and non-hyaline terminal area of each wing black.

♂ genitalia (Text-figs 345, 346). Closely similar to those of *corroborata*; differing in the form of the fusion of the membranous part of the valve with the sclerotized dorsal margin, tapered to an acute angle in *corroborata*, bluntly rounded in *undimarginata*; differing also in the broader, less tapered apical half of the aedeagus and in the shorter fulcrum, the apex of which is curved dorsad and does not extend beyond the tip of the aedeagus.♀ genitalia. Similar to those of *corroborata*.

Measurements. Fore wing: ♂ 18–20 mm; ♀ 17–19 mm. Antennal pectinations: ♂ 10 ×, ♀ 4 × diameter of shaft.

The colour and pattern of the species are diagnostic; other similarly coloured species in the *perlepidata*-group differ in the presence of a large black discal spot on the fore wing.

DISTRIBUTION. Nigeria, Cameroun, Gabon.

## MATERIAL EXAMINED.

*Zamarada undimarginata* Warren, holotype ♂, NIGERIA: Rio Niger, Akassa, Geometridae genitalia slide no. 6352, in BMNH.NIGERIA: 1 ♂; Uwet, 16.xi, 1 ♂; Omo, vii. 1960 (*J. Boorman*), 1 ♀. CAMEROUN: Dokoa, Savanes de la Sanaga (*P. Darge*), 1 ♂; M'balmayo, 27.viii.1967 (*P. Darge*), 1 ♂ (both coll. Herbulot, Paris); Efulen, ix, x, xii (*H. L. Weber*), 6 ♂, 3 ♀ (CM, Pittsburgh). GABON: Savanes de Mwadi, près du Iézé, 26.iii.1963 (*G. Bernardi*), 1 ♀ (MBG, Paris).THE *PRINCIPIS*-GROUPIn the male genitalia the uncus is well developed and strongly sclerotized, variable in form but usually truncate with a ventrally inclined projection from mid-apical margin; laterally rounded, almost spherical in form in *clavigera* and *bilobata*; tricuspid in *tricuspidata* and tapered to a round apex in *rupta*, *merga* and *subincoloris*. Ventral plate of gnathus strongly sclerotized, also variable in form. Valve with either dorsal or ventral, or with both apices produced; setose projection from base of dorsal process always very slender and digitate. Apical half of aedeagus finely tapered, usually quite smooth; a minute, thorn-like projection present in *merga*, *subincoloris* and *xyle* and an acicular projection at one-half in *onycha*. Fulcrum scobinate at apex. Vesica without cornutus.

The male hind tibia is dilate, enclosing a grey or buff hair-tuft, tuft equal in length to tibia.

In the female genitalia both lamellae in the sterigma are strongly sclerotized and elaborately developed. Posterior part of corpus bursae usually sclerotized.



## KEY TO SPECIES

- 1 Apex of ventral plate of gnathus deeply excavate to approximately one-third or more of total depth of plate . . . . . 2
- Ventral plate of gnathus not so formed . . . . . 3
- 2 (1) Ventral plate of gnathus subequal in width to that of uncus; apical margin excavate in U-shaped form to one-third of depth of plate, greatest width of excavation one-half width of plate. . . . . *bilobata* (p. 214)
- Ventral plate of gnathus broader than uncus, broadly excavate to three-fifths of depth of plate, greatest width of excavation three-fourths width of plate . . . . . *clavigera* (p. 213)
- 3 (1) Apical margin of ventral plate of gnathus arcuate and scobinate, broader than base . . . . . 4
- Ventral plate of gnathus of even width or tapered, apical margin not broader than base . . . . . 5
- 4 (3) Uncus trapezoid, truncate apex narrower than base. Apex of dorsal margin of valve broad and multi-spined, curved towards uncus (Text-fig. 347). Distribution: Principe I. . . . . *principis* (p. 211)
- Uncus almost square, truncate apex equal in width to base. Apex of dorsal margin of valve tapered to single spine, curved towards uncus (Text-fig. 349). Distribution: Fernando Po, W. African mainland *platycephala* (p. 211)
- 5 (3) Valve: apex of dorsal margin turned abruptly through 90 degrees towards ventral margin; ventral margin produced beyond level of apex of dorsal margin, strongly sclerotized, spatulate in form and scobinate (Text-fig. 364) . . . . . *rupta* (p. 217)
- Valve not so formed . . . . . 6
- 6 (5) Apex of valve bifurcate . . . . . 7
- Apex of valve curved through 120-90 degrees towards uncus and tapered apicad, surface smooth or scobinate . . . . . 9
- 7 (6) Aedeagus with acicular projection at one-third, projection one and one-half times as long as greatest width of aedeagus . . . . . *onycha* (p. 216)
- Aedeagus not so formed . . . . . 8
- 8 (7) Uncus evenly tapered to rounded apex. Apex of valve deeply bifurcate; ventral and dorsal arms longer than width of valve at point of cleavage . . . . . *merga* (p. 218)
- Uncus truncate at apex; a short, beak-like point projects ventrad from mid-apical margin. Valve shallowly bifurcate; extended angular apices of ventral and dorsal margins shorter than width of valve at point of cleavage . . . . . *bicuspidata* (p. 214)
- 9 (6) Apex of uncus tricuspid . . . . . *tricuspidata* (p. 212)
- Uncus not so formed . . . . . 10
- 10 (9) Apex of uncus rounded. Apical fourth of fulcrum dilate, dorsal surface with two parallel, coarsely serrate ridges . . . . . *subincoloris* (p. 220)
- Apices of uncus and fulcrum not so formed . . . . . 11
- 11 (10) Uncus almost square in shape, with a short, ventrally inclined projection from mid-apical margin. Ventral plate of gnathus very strongly sclerotized, apex shallowly bilobate. Apex of fulcrum broadened, shallowly bifurcate and coarsely scobinate . . . . . *xyele* (p. 221)
- Uncus, gnathus and fulcrum not so formed . . . . . 12
- 12 (11) Dorsal margin of valve excavate just below apex, which is short and smoothly acicular . . . . . *consummata* (p. 216)
- Valve not so formed; tapered apex coarsely scobinate . . . . . 13
- 13 (12) Fulcrum broadened medially, then tapered apicad. Uncus trapezoid, apical

margin two-thirds as broad as base. Apex of ventral plate of gnathus broadly rounded (Text-figs 370, 371) . . . . . *gamma* (p. 219)  
 - Fulcrum of even width from base to apex. Apical margin of uncus one-half as wide as base, narrowly and shallowly notched medially. Apex of ventral plate of gnathus narrowly rounded (Text-figs 368, 369) . . . . . *lima* (p. 218)

***Zamarada principis* Herbulot**

(Text-figs 347, 348; Pl. 74, figs 748, 749; Pl. 117, fig. 1052)

*Zamarada principis* Herbulot, 1958 : 101, text-fig. 2. Holotype ♂, PRINCIPE I. (MNHN, Paris) [examined].

♂♀ (Pl. 117, fig. 1052). Hyaline area of wings tinged with violet, striate with greyish brown and finely edged distally with black; discal spots pearl-grey, large and outlined with greyish brown on fore wing, slender on hind wing. Costa of fore wing orange-yellow striate with greyish brown. Non-hyaline terminal area of each wing greyish brown (pl. 5, D3); dentate subterminal fascia marked in a browner tone. Underside of non-hyaline terminal area and large discal spot on fore wing dark grey.

♀. Differs in the brownish orange colour (pl. 5, C5) of the discal spot on the fore wing and of the non-hyaline terminal area of each wing; the subterminal fascia is of a more orange tone (pl. 5, C6)

♂ genitalia (Text-figs 347, 348). Uncus trapezoid, truncate apex narrower than base. Apical margin of ventral plate of gnathus arcuate and scobinate, broader than base. Dorsal margin incurved towards uncus apicad, apices asymmetrical with three thorn-like projections on left side and two on right. Apex of fulcrum scobinate, inclined towards and extending to tip of aedeagus.

♀ genitalia (Pl. 74, figs 748, 749). Sterigma crenulate laterally, crenulations extending well beyond level of posterior margin of lamella postvaginalis, which is shallowly recessed and almost straight. Lamella antevaginalis equal in length and breadth, posterior margin shallowly bilobate and minutely serrate.

Measurements. Fore wing: ♂ 17.5 mm, ♀ 18 mm. Antennal pectinations: ♂ 11 ×, ♀ 3 × diameter of shaft.

Known only from Principe Island and distinct in the uniformly coloured, non-hyaline terminal area of the wings, lacking the contrast of the strongly marked subterminal fascia found in related species. In the male genitalia the form of the uncus, gnathus and apex of the valve are diagnostic. In the female genitalia the only example available for study differs from *platycephala* in the shorter lamellae, the lamella postvaginalis having an almost straight posterior margin, only shallowly recessed.

DISTRIBUTION. Principe Island.

**MATERIAL EXAMINED.**

*Zamarada principis* Herbulot, holotype ♂, PRINCIPE I.: 150 m, Infante Dom Henrique (forêt), 26-27.vi.1956 (*P. Viette*), in MNHN, Paris.

Paratype ♀, same data, in MNHN, Paris.

***Zamarada platycephala* sp. n.**

(Text-figs 349, 350; Pl. 74, figs 747, 750, 751; Pl. 75, fig. 756; Pl. 117, fig. 1050)

♂ (Pl. 117, fig. 1050). Hyaline area of wings yellowish grey, striate with grey, more densely

along posterior margin, and finely edged distally with black and silvery grey; discal spots grey, that on fore wing heavily outlined with a darker shade. Non-hyaline terminal area light brown (pl. 5, D5, clay), greyer proximad of the darker brown, dentate subterminal fascia, which is edged distally with light buff; darker brown also in apical area of each wing and in tornal area of hind wing. In some examples the non-hyaline terminal area is suffused with greyish brown and the subterminal fascia marked in a darker grey.

♀. The paler part of the non-hyaline terminal area, that is between veins  $M_3$  and  $Cu_{1b}$  on the fore wing and posterior of vein  $M_3$  on the hind wing, is usually greyish orange, contrasting more markedly with the darker areas, and the subterminal fascia is usually poorly defined.

Underside of non-hyaline terminal area and discal spots in both sexes dark brown.

♂ genitalia (Text-figs 349, 350). Uncus almost square, truncate apex equal in width to base; apical margin sometimes slightly crenulate. Ventral plate of gnathus similar to that of *principis* but broader, posterior margin sometimes shallowly excavate medially. Valves symmetrical; ventral and dorsal margins produced and tapered, apex of dorsal margin acicular and curved towards uncus.

♀ genitalia (Pl. 74, figs 747, 750, 751; Pl. 75, fig. 756). Sterigma usually conspicuously crenulate laterally. Posterior margin of lamella postvaginalis shallowly and broadly excavate, laterally straight or convex. Lamella antevaginalis variable in form.

Measurements. Fore wing: ♂ 15–18 mm; ♀ 13–17 mm. Antennal pectinations: ♂ 13 ×, ♀ 2 × diameter of shaft.

Structurally closely akin to *principis*; distinguished in the male genitalia by the form of the uncus, ventral plate of the gnathus and by the form of the valve, the dorsal margin of which is tapered apicad to a single spine incurved towards the uncus. The female genitalia are closely similar to those of *principis*, differing in the grosser lamellae; the lamella postvaginalis extends almost as far posteriorly as the crenulate lateral margins of the sterigma and its posterior margin is more deeply recessed.

DISTRIBUTION. W. Africa, Fernando Po, Sierra Leone to Cameroun.

Holotype ♂, CAMEROUN ('Kamerun'): Efulen, 21.vi.1922 (*H. L. Weber*), in CM, Pittsburgh.

Paratypes. SIERRA LEONE, 1 ♂ (UM, Oxford). LIBERIA: Marshall Terr., Harbel, 16.xi.1965 (*R. M. Fox*), 1 ♂ (CM, Pittsburgh). IVORY COAST: Bingerville, vi–vii. 1915 (*G. Melou*), 1 ♂, 2 ♀. NIGERIA: Warri, iv–vii (*Dr Roth*), 5 ♂, Lagos, 1 ♀ (all BMNH). CAMEROUN: Johann-Albrechts Höhe, 27.v.1896 (*L. Conradt*), 1 ♂ (MNHU, Berlin); N'Kongsamba, 1.iv.1958 (*P. Darge*), 1 ♂; Nlong, vii–viii.1952, 1 ♂; 8 km N. d'Edea, iii–iv. 1970 (*C. Herbulot*), 3 ♂, 4 ♀; M'Balmayo, Ecole forestière, 7.x.1971 (*P. Darge*), 1 ♂ (all coll. Herbulot, Paris); Lolodorf, 1894–1895 (*L. Conradt*), 3 ♂ (BMNH); Efulen, i–ix (*H. L. Weber*), 10 ♂, 4 ♀; ibidem, x, 6 ♂, 2 ♀; ibidem, xi–xii, 3 ♂ (all CM, Pittsburgh). FERNANDO Po (*Rev. W. Cooper*), 2 ♂ (BMNH).

### *Zamarada tricuspidata* sp. n.

(Text-figs 351, 352; Pl. 117, fig. 1055)

♂ (Pl. 117, fig. 1055). Externally similar in colour and pattern to female specimens of *platycephala* with well contrasted paler, orange-grey areas in the otherwise dark non-hyaline terminal area on the fore wing distad of the subterminal fascia between veins  $M_3$  and  $Cu_{1b}$  and on the hind wing posterior of the fold representing vein  $M_2$  and at the anal angle.

♂ genitalia (Text-figs 351, 352). Apex of uncus tricuspid, rather more strongly developed in the paratype that is illustrated than in the holotype. Ventral plate of gnathus strongly sclerotized, tapered and minutely but densely scobinate. Valve tapered and incurved towards uncus, ventral margin minutely serrate and scobinate. Fulcrum sinuous, scobinate apex extending beyond that of aedeagus.

♀ unknown.

Measurements. Fore wing: ♂ 18–19 mm. Antennal pectinations: ♂ 8 × diameter of shaft.

In the genitalia the tricuspid form of the uncus and the evenly tapered and curved valve with its serrate ventral margin are diagnostic.

DISTRIBUTION. Zaire, Cameroun.

Holotype ♂, ZAIRE ('Belgian Congo'): Upper Congo, Yakusu, v. 1900 (*K. Smith*), Geometridae genitalia slide no. 7643, in BMNH.

Paratypes. ZAIRE ('Belgian Congo'): Sankaru, Katako-Kombe, 10.x.1952 (*Dr M. Fontaine*), 1 ♂ (MRAC, Tervuren). CAMEROUN: Savanes d'Akak, 14 km N.N.E. of Yaoundé, 20.ix.1971 (*P. Darge*), 1 ♂; N'Kolbisson, 7 km W. de Yaoundé, 700 m, 15–18.iv.1972 (*C. Herbulot*), 1 ♂ (both coll. Herbulot, Paris).

A further male from Kinshasa (Leopoldville), with very short lateral points on the uncus, a less finely tapered ventral plate of the gnathus and a broader, less tapered valve is provisionally associated with *tricuspid*a, but excluded from the type-series. The full data are: ZAIRE ('Belgian Congo'): Leopoldville, 11.xi.1953 (*Dr M. Fontaine*), 1 ♂ (MRAC, Tervuren).

### *Zamarada clavigera* sp. n.

(Text-figs 353, 354; Pl. 75, figs 752, 755)

♂ genitalia (Text-figs 353, 354). Uncus laterally rounded, apex shallowly bilobate, reminiscent of a larval head-capsule. Ventral plate of gnathus broader than uncus, broadly excavate to three-fifths of depth of plate, greatest width of excavation three-fourths width of plate; club-like apices of lateral margins sclerotized and scobinate. Apices of ventral and dorsal margins of valve produced and tapered.

♀ genitalia (Pl. 75, figs 752, 755). Sterigma with tapered, lateral projections.

Measurements. Fore wing: ♂ 16–17 mm; ♀ 15.0–16.5 mm. Antennal pectinations: ♂ 10 ×, ♀ 4 × diameter of shaft.

Closely similar in colour and pattern to *tricuspid*a. Distinguished externally in the male by the less dilate hind tibia, which encloses a buff, not grey tuft of long hair-scales. In the male genitalia the form of the uncus and ventral plate of the gnathus and in the female genitalia the form of the sterigma are diagnostic.

DISTRIBUTION. Gambia, Cameroun, Gabon.

Holotype ♂, CAMEROUN ('Fr. Cameroons'): Yabassi Dist., Lat. 4° N., Long. 10° E., xii. 1937, dry season (*F. G. Merfield*), Geometridae genitalia slide no. 7711, in BMNH.

Paratypes. GAMBIA (*Moloney*), 1 ♂ (BMNH). CAMEROUN: Victoria, 1890 (*Teusz*), 1 ♂ (MNHU, Berlin); holotype data, 1 ♀; Johann-Albrechts Höhe, 1896



(*L. Conradt*), 1 ♂ (both BMNH); 8 km N. d'Edea, 30.iii–i.iv.1970 (*C. Herbulot*), 1 ♀; ibidem, 10.iv.1970, 2 ♀ (both coll. Herbulot, Paris). GABON: Makokou, Colline Mission biologique, 4.xi.1967 (*G. Bernardi*), 1 ♂ (MBG, Paris); Mouila, 15–22.x.1964 (*P. Darge*), 1 ♂, 1 ♀ (coll. Herbulot, Paris).

### *Zamarada bilobata* sp. n.

(Text-figs 355, 356)

♂ genitalia (Text-figs 355, 356). Uncus laterally rounded, apex shallowly bilobate. Ventral plate of gnathus subequal in width to that of uncus; apical margin excavate in U-shaped form to one-third of depth of plate, greatest width of excavation one-half width of plate; apices of lateral margins strongly sclerotized and minutely scobinate.

♀ unknown.

Measurements. Fore wing: 17–19 mm. Antennal pectinations: ♂ 10 × diameter of shaft.

Closely similar in colour, pattern and leg structure to *platycephala* and distinguished only by the genitalia. Most closely related to *clavigera*; distinguished from it by the dense tuft of grey rather than buff hair-scales on the hind tibia, by the form of the uncus, by the narrower ventral plate of the gnathus with its shallower, narrower U-shaped excavation and by the longer, acicular extension of the dorsal margin of the valve.

DISTRIBUTION. Gabon.

Holotype ♂, GABON: Mouila, 7.x.1964 (*P. Darge*), in coll. Herbulot, Paris.

Paratypes. GABON: Mouila, 15.ix.1964 (*P. Darge*), 1 ♂; ibidem, 8.x.1964, 1 ♂ (both coll. Herbulot, Paris).

### *Zamarada bicuspidata* sp. n.

(Text-figs 357–359; Pl. 75, figs 753, 754; Pl. 117, fig. 1049)

♂ ♀ (Pl. 117, fig. 1049). Hyaline area of wings yellowish grey sparsely striate with grey, mainly along posterior margins; costa of fore wing buff striate with grey; discocellulars on hind wing slenderly grey, those on fore wing buff, edged proximally with pearl-grey and dark grey. Non-hyaline terminal area light brown (pl. 6, D4) to greyish brown (pl. 6, D3); dentate subterminal fascia dark brown to black, finely pale-edged distally; termen of hind wing tinged with greyish orange; cilia chequered greyish orange and dark grey. Underside of non-hyaline terminal area and of discal mark on fore wing dark grey; cilia similar to those of upperside.

A short series of three males and two females from Fernando Po (all the males and one of the females are from the Moka Plateau) has genitalia similar to those of the type-series, but resembles *platycephala* in colour and may represent a subspecies; the hyaline area of the wings is more densely striate with grey and the non-hyaline terminal area is grey with a brown subterminal fascia. A male from Santa Isabel on Fernando Po matches the type-series.

♂ genitalia (Text-figs 357–359). Uncus truncate with a short, beak-like point projecting ventrad from mid-apical margin. Ventral plate of gnathus tapered, apex narrowly rounded. Valve shallowly bifurcate, extended angular apices of ventral and dorsal margins shorter than width of valve at point of cleavage. Aedeagus finely tapered. Fulcrum with thorn-like apex.

The apices of the valves vary in length; in some examples the tip of the ventral margin extends further than that of the dorsal margin (Text-fig. 359); in the holotype and in other examples the relative lengths are reversed (Text-fig. 358).

♀ genitalia (Pl. 75, figs 753, 754). Sterigma narrowed medially. Lamella antevaginalis narrowed anteriorly; posterior margin excavate medially and minutely serrate. Lamella postvaginalis shortly produced medioposteriorly, the extension minutely bilobate.

Measurements. Fore wing: ♂ 17–20 mm; ♀ 16–19 mm. Antennal pectinations: ♂ 8 ×, ♀ 4 × diameter of shaft.

Typical examples may be distinguished from *platycephala* by the clearer hyaline area of the wings and by the more uniformly greyish brown non-hyaline terminal area, with its heavily marked, darker subterminal fascia. Structurally the form of the uncus and the tapered apices of the bifurcate valve in the male genitalia and the form of the medially narrowed sterigma in the female genitalia are diagnostic.

DISTRIBUTION. W. Africa, Senegal to Gabon, Fernando Po.

Holotype ♂, IVORY COAST: Bingerville, 1–7.vi.1915 (*G. Melou*), Geometridae genitalia slide no. 7715, in BMNH.

Paratypes. SENEGAL: Sedhiou, 4.i.1917 (*H. Castell*), 1 ♀; ibidem, 5–12.vii.1917, 1 ♀; 1–20.x.1917, 2 ♀. GUINEA: Rio Numez, Boké, 1 ♂ (BMNH); Beyla (*Dr Mir. Mrázek*), 5 ♂, 1 ♀ (MM, Brno). SIERRA LEONE: Bo, vi. 1969 (*R. J. Revell*), 2 ♂ (BMNH). LIBERIA: Marshall Terr., Harbel, 16.i.1957 (*R. M. Fox*), 1 ♂; ibidem, 9.xii.1956, 1 ♂ (both CM, Pittsburgh). IVORY COAST: Bingerville, vi–viii, xi (*G. Melou*), 3 ♂, 4 ♀ (all BMNH); Abidjan, 1 ♂ (NMK, Nairobi); Yapo-Sud, 22 km S.S.E. of Agboville, 12–18.iv.1969 (*C. Herbulot*), 1 ♀; Lamto, 36 km N.N.W. of Tiassalé, 20–23.iv.1969 (*C. Herbulot*), 3 ♂, 1 ♀ (all coll. Herbulot, Paris). GHANA: Bibiani (Bibianaha), 70 miles N.W. of Dunkwa (Dimkwa), 700 ft, 26.xi.1910 (*H. G. F. Spurrell*), 1 ♀; Ashanti, Juaso (*G. H. Gibbs*), 1 ♂; Juaso, 900 ft, 5.xii.1937 (*G. S. Cansdale*), 1 ♀; Kumasi, 3 ♀; 20 miles W. & N.W. of Sekondi (*L. R. Tesch*), 1 ♂. NIGERIA: Ibadan, 1954 (*J. Bowden*), 2 ♂; Omo Forest, 23.vii.1960 (*J. Riley*), 1 ♂; Lagos, 1 ♂, 1 ♀; ibidem, vii. 1960 (*J. Boorman*), 1 ♂, 1 ♀; Iju, 15 miles N.N.E. of Lagos, v. 1960 (*J. Boorman*), 4 ♂; Ilesha (*Capt. Humfrey*), 1 ♂, 1 ♀; Niger Coast, 1 ♂; Sapele (*F. W. Sampson*), 1 ♀; Ikom, ii. 1957 (*J. Boorman*), 1 ♂, 1 ♀; Old Calabar (*F. G. Pudney*), 1 ♂ (all BMNH). CAMEROUN: Manengouba, 1040 m., 20.x.1971 (*P. Darge*), 1 ♀; N’Kongsamba, 5.iv.1958 (*P. Darge*), 1 ♂ (both coll. Herbulot, Paris); Ekona, 10.xii.1936, 1 ♂ (MRAC, Tervuren); Yaoundé Stat., 11.vi.1897 (*Carhap*), 1 ♀ (MNHU, Berlin); Yaoundé, 30.i.1970 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris); Johann-Albrechts Höhe, 1896 (*L. Conradt*), 1 ♀; Bitje, 2000 ft (*G. L. Bates*), 1 ♂ (both BMNH); Abong-Mbang, 9.xi.1962, Oxford Univ. Exped., 1 ♂ (NMR, Bulawayo). CENTRAL AFRICAN REPUBLIC: Bangui, iii. 1968 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris). ZAIRE (‘Belgian Congo’): Matadi, iv. 1931 (*A. Dumez*), 1 ♂ (MNHN, Paris). GABÓN: Mouila, 10.x.1964 (*P. Darge*), 1 ♀ (coll. Herbulot, Paris).

Associated with *bicuspidata*, but excluded from type-series. FERNANDO PO: (*W. Cooper*), 1 ♀; Moka, 28.i–3.ii.1933 (*W. H. T. Tams*), 3 ♂, 1 ♀ (all BMNH); Santa Isabel, 5.ix.1916 (*G. Tessmann*), 1 ♂ (MNHU, Berlin).

*Zamarada consummata* (Prout MS) sp. n.

(Text-figs 360, 361; Pl. 116, fig. 1045)

♂ (Pl. 116, fig. 1045). Similar in colour and pattern to *bicuspidata*, with which it flies in Cameroun; distinguished by its larger size and broader intrusions of hyaline into the non-hyaline terminal area of each wing, characters more marked in Congo and Uganda specimens than in those from Cameroun.

♂ genitalia (Text-figs 360, 361). Closely similar to those of *bicuspidata*, differing in the form of the valve: the ventral margin is evenly curved towards the dorsal margin, the latter excavate just below the apex, which is short and smoothly acicular.

♀ unknown.

Measurements. Fore wing: ♂ 19–22 mm. Antennal pectinations: ♂ 9 × diameter of shaft.

DISTRIBUTION. Uganda, Zaire, Cameroun.

Holotype ♂, ZAIRE ('Belgian Congo'): W. Kivu, South Lowa District, Lowowo Valley, 4000 ft, mountain forest, iii. 1924, wet season (*T. A. Barns*), Geometridae genitalia slide no. 7716, in BMNH.

Paratypes. UGANDA: Jinja, Mabira Forest, x. 1962, 1 ♂; Toro, Kibale Forest, v. 1966, 3 ♂; Bwamba, v. 1958, 1 ♂ (all *R. H. Carcasson*, in NMK, Nairobi). ZAIRE ('Belgian Congo'): Escarpment, west Semliki Valley, 20 miles S.W. of Boga, 3000–4000 ft, borders of tropical forest and long grass country, vii. 1924 (*T. A. Barns*), 1 ♂ (BMNH); Kibali-Ituri, Nioka, 4.x.1954 (*J. Hecq*), 1 ♂; Uele, Paulis, 6.viii.1959 (*Dr M. Fontaine*), 1 ♂ (both MRAC, Tervuren). CAMEROUN: Bitje, 1 ♂; Bitje, Ja River, x–xi. 1913, wet season, 1 ♂ (both BMNH); Sangmelima, 6.iv.1932 (*A. I. Good*), 1 ♂; Efulen, 10.iv.1913 (*H. L. Weber*), 1 ♂; ibidem, 19.v.1917, 1 ♂ (all CM, Pittsburgh); M'Balmayo, Ecole forestière, 11.ix.1971, 1 ♂; Savanes d'Akak, 14 km N.N.E. of Yaoundé, 1 ♂, 1 ♀ (all *P. Darge*, in coll. Herbulot, Paris).

*Zamarada onycha* sp. n.

(Text-figs 362, 363; Pl. 117, fig. 1053)

♂ (Pl. 117, fig. 1053). Hyaline area of wings tinged with yellow and finely edged distally with dark brown; costa and posterior margin of fore wing yellow striate with brownish grey, more densely on costa; discocellulars finely yellow, those on fore wing edged with brownish grey. Non-hyaline terminal area brownish orange (pl. 5, C5–C6) tinged with reddish grey proximad of the dentate subterminal fascia, which is weakly marked in a dark shade of brownish orange and slenderly edged distally with glossy buff. Underside of discal spot on fore wing and of non-hyaline terminal area brown, the latter becoming paler terminad and tinged with yellow at anal angle of hind wing.

♂ genitalia (Text-figs 362, 363). Uncus tapered to rounded apex, from which a short, blunt projection extends ventrad. Ventral plate of gnathus tapered to narrowly rounded apex, extending almost to tip of uncus. Apex of valve bifurcate; apex of ventral margin acutely angled or rounded, apex of dorsal margin produced in digitate form. Aedeagus finely tapered and blade-like with an acicular projection at one-third, the projection one and one-half times as long as greatest width of aedeagus. Fulcrum stout, apex curved and scobinate, extending over and beyond tip of aedeagus.

♀ unknown.

Measurements. Fore wing: ♂ 20 mm. Antennal pectinations: ♂ 7.5 × diameter of shaft.

Distinguished externally from related species by size and combination of yellowish hyaline area and over-all pinkish brown non-hyaline terminal area. Structurally the form of the uncus, ventral plate of the gnathus, the bifurcate valve and the aedeagus with its acicular projection are diagnostic.

DISTRIBUTION. Zaire.

Holotype ♂, ZAIRE ('Belgian Congo'): Sankaru, Katako-Kombe, 6.ix.1952 (*Dr M. Fontaine*), in MRAC, Tervuren.

Paratypes. ZAIRE ('Belgian Congo'): holotype data, 21.ix.1952, 1 ♂; ibidem, 10.x.1952, 1 ♂; Lusambo, 3.ix.1950 (*Dr M. Fontaine*), 1 ♂; Ifuta [4°02' S. 22°25' E.], 31.x.1921 (*L. Verlaïne*), 1 ♂ (all MRAC, Tervuren); Equateur, Ikela, Loile River, iv. 1959 (*R. H. Carcasson*), 1 ♂ (BMNH).

### *Zamarada rupta* sp. n.

(Text-figs 364, 365; Pl. 117, fig. 1056)

♂ (Pl. 117, fig. 1056). Hyaline area of wings yellowish grey, moderately densely striate with brownish grey, the striae having a purplish tinge in oblique light, and finely edged distally with brown; costa yellowish orange striate with iron-grey; discocellulars brown, that on hind wing slender, that on fore wing ovate and mixed with grey. Non-hyaline terminal area of wings light brown to yellowish brown (pl. 5, D5, clay); dentate subterminal fascia weakly defined in a more orange coloured or darker brown, finely edged distally with glossy buff. Cilia chequered light and dark brown. Underside of non-hyaline terminal area and of discal spot on fore wing greyish brown.

♂ genitalia (Text-figs 364, 365). Uncus tapered to small, strongly sclerotized point. Ventral plate of gnathus tapered to broadly rounded apex, plate extending to one-half length of uncus. Apex of valve with fractured appearance; apex of dorsal margin curved abruptly ventrad through 90 degrees towards ventral margin and minutely serrate; ventral margin produced beyond level of apex of dorsal margin, strongly sclerotized, spatulate in form and scobinate. Fulcrum similar to that of *platycephala*, but more extensively and more coarsely scobinate.

♀ unknown.

Measurements. Fore wing: ♂ 19 mm. Antennal pectinations: ♂ 9 × diameter of shaft.

Distinguished externally from *platycephala* by the more extensive striation of the hyaline area and by the more uniformly coloured non-hyaline terminal area of each wing; distinguished from *subincoloris* by the dense tuft of brownish grey rather than buff hair-scales on the dilate hind tibia. Structurally the form of the valve in the male genitalia is diagnostic.

DISTRIBUTION. Cameroun, Gabon.

Holotype ♂, CAMEROUN ('Kamerun'): Efulen, 7.x.1912 (*H. L. Weber*), in CM, Pittsburgh.

Paratypes. CAMEROUN: holotype data, 18.iv.1923, 1 ♂; ibidem, 7.vi.1923, 1 ♂ (both CM, Pittsburgh). GABON: Belinga, Camp Central, 500 m, 22.iii.1963 (*G. Bernardi*), 1 ♂ (MBG, Paris).



*Zamarada merga* sp. n.

(Text-figs 366, 367; Pl. 117, fig. 1054)

♂ (Pl. 117, fig. 1054). Externally closely similar in colour and pattern to *subincoloris*, from which it may be distinguished by the colour of the underside of the non-hyaline terminal area of the wings, which is brownish orange, only the terminal half of the fore wing being suffused with brownish grey.

♂ genitalia (Text-figs 366, 367). These, which suggest a closer affinity with *rupta*, are diagnostic in the form of the bifurcate valve. Uncus evenly tapered to narrowly rounded tip. Ventral plate of gnathus tapered, as illustrated, the perimeter minutely scobinate. Valve deeply bifurcate at apex, ventral and dorsal arms longer than width of valve at point of cleavage; ventral arm produced to a stout, fine point, dorsal arm irregularly margined and tapered to a thorn-like tip, which is inclined towards the uncus. Aedeagus tapered and blade-like with a minute, thorn-like projection at one-half. Apical fourth of fulcrum scobinate.

♀ unknown.

Measurements. Fore wing: ♂ 17 mm. Antennal pectinations: ♂ 8 × diameter of shaft.

DISTRIBUTION. Gabon.

Holotype ♂, GABON: Belinga, Camp Central, 500 m, 25.iii.1963 (*G. Bernardi*), in MBG, Paris.

*Zamarada lima* sp. n.

(Text-figs 368, 369; Pl. 76, figs 757, 758; Pl. 117, fig. 1051)

♂♀ (Pl. 117, fig. 1051). Hyaline area of wings weakly tinged with green, varying striate with brownish grey and finely edged distally with dark brown; brownish grey striation with purplish tinge in oblique light; costa of fore wing orange-yellow densely striate with silvery grey, except for two spots in basal half; discocellulars silvery grey, slenderly marked on hind wing, ovate on fore wing. Non-hyaline terminal area of each wing uniformly brownish grey (pl. 5, D2), or a shade darker; dentate subterminal fascia brownish yellow, dentations dark brown distally, fascia edged distally with glossy buff; cilia chequered greyish yellow and brownish grey. Underside of non-hyaline terminal area and discal spot on fore wing greyish brown, anal angle of hind wing often paler.

♂ genitalia (Text-figs 368, 369). Uncus tapered to notched tip with a short blunt projection inclined ventrad; apical margin one-half as wide as base. Apical margin of ventral plate of gnathus narrowly rounded. Valve incurved towards uncus apicad, apex finely tapered and scobinate; a very short, digitate projection from ventral margin at point of curve. Fulcrum of even width from base to apex.

♀ genitalia (Pl. 76, figs 757, 758). Lamellae slender and scobinate; posterior margin of each notched medially. Corpus bursae sclerotized posteriorly.

Measurements. Fore wing: ♂ 14–19 mm; ♀ 15.0–17.5 mm. Antennal pectinations: ♂ 12.5 ×, ♀ 3 × diameter of shaft.

Distinguished externally by the uniformly coloured non-hyaline terminal area and the brightly coloured and well contrasted subterminal fascia; small examples might be confused with *euerces* in the *metrioscaphes*-group by reason of the large, pale grey discal spot on the fore wing, but the male of *euerces* may be distinguished by the simple hind tibia. In the male genitalia the form of the tapered, scobinate valve and the even width of the fulcrum and in the female the form of the scobinate lamellae are diagnostic.

DISTRIBUTION. Tanzania (Amani).

Holotype ♂, TANZANIA: E. Usambara, Amani, xi. 1965 (R. H. Carcasson), in BMNH.

Paratypes. TANZANIA: Amani, iii-iv. 1936 (B. Cooper), 2 ♂, 1 ♀; ibidem, i. 1950 (P. R. O. Bally), 1 ♂ (all BMNH); E. Usambara Mts, Amani, ii. 1953 (E. Pinhey), 1 ♂, 2 ♀ (BMNH), 1 ♂, 2 ♀ (NMK, Nairobi); ibidem, iv. 1952 (C. Howard), 1 ♂, 1 ♀ (BMNH), 1 ♀ (NMK, Nairobi); holotype data, 1 ♂, 1 ♀ (BMNH), 2 ♂, 2 ♀ (NMK, Nairobi); Amani, 3.iv.1908, 1 ♀ (MNHU, Berlin); Amani, 21-30.iv.1969 (Watulege), 2 ♂ (coll. Herbulot, Paris).

### *Zamarada gamma* Fletcher

(Text-figs 370, 371; Pl. 76, figs 759, 760; Pl. 118, fig. 1060)

*Zamarada gamma* Fletcher, 1958a: 143, pl. 2, figs 13, 15; pl. 5, figs 32, 34, 37. Holotype ♂, MALAWI (BMNH) [examined].

♂ ♀ (Pl. 118, fig. 1060). Hyaline area of wings light yellow tinged with green in oblique light, very finely and sparsely striate with grey and finely edged distally with dark brown; costa of fore wing yellowish orange striate with grey; middle of discocellulars marked with a minute, dark dot. Non-hyaline terminal area narrow, greyish brown (pl. 7, D3); subterminal fascia dentate and broken, dark brown, sometimes suffusing to termen in discal area; sometimes dark brown edged proximally with yellow and finely edged distally with glossy buff; cilia chequered greyish yellow and dark brown. Underside of non-hyaline terminal area and slender discal spot on fore wing greyish brown.

♂ genitalia (Text-figs 370, 371). Uncus trapezoid; apical margin shallowly incised medially, two-thirds as broad as base, with a short projection from the ventral surface. Ventral plate of gnathus broadly based and broadly rounded at apex. Valve similar to that of *lima*, but ventral margin smoothly curved apicad, without a minute digitate projection at point of curve. Fulcrum broadened medially, then finely tapered to scobinate tip.

♀ genitalia (Pl. 76, figs 759, 760). Lamella postvaginalis strongly sclerotized, stout and Y-shaped. Lamella antevaginalis almost as broad as long, posterior margin incised medially. Corpus bursae sclerotized at posterior extremity.

Measurements. Fore wing: ♂ 16.5-18.0 mm; ♀ 15-18 mm. Antennal pectinations: ♂ 9 ×, ♀ 3 × diameter of shaft.

Distinguished externally by the almost immaculate light yellow or greenish tinged hyaline area and narrowly patterned terminal fourth. In the male genitalia the form of the fulcrum, smoothly and evenly broadened medially, and of the valve and in the female the form of the sterigma are diagnostic.

DISTRIBUTION. Malawi, Zambia, Zaire, Burundi, Tanzania, Uganda.

### MATERIAL EXAMINED.

*Zamarada gamma* Fletcher, holotype ♂, MALAWI ('Nyasaland'): Mt Mlanje, 24.iii.1913 (S. A. Neave), Geometridae genitalia slide no. 3464, in BMNH.

MALAWI: holotype locality, ii, iv, v, ix, 4 ♂, 2 ♀; Mlanje, Lucheny River, 16.ii.1914 (S. A. Neave), 1 ♂ (all *Zamarada gamma* Fletcher paratypes, in BMNH); Cholo, 2700 ft (R. C. Wood), 1 ♀ (CM, Pittsburgh). ZAMBIA: (H. C. Dollman),

1 ♀; Fort Jameson (*A. A. Longshaw*), 1 ♀ (both *Zamarada gamma* Fletcher paratypes, in BMNH); Abercorn, xi. 1963 (*E. S. Brown*), 1 ♀. ZAIRE ('Belgian Congo'): Elisabethville, xi, xii. 1956 (*C. Seydel*), 1 ♂, 1 ♀ (all BMNH). BURUNDI: Usumbura, 900 m, 15.vi.1961, 1 ♀; Kitega, 21.v.1962, 1 ♀ (both *Dr M. Fontaine*, in MRAC, Tervuren). TANZANIA: Tendaguru, Bez. Lindi (*Janensch*), 1 ♀ (*Zamarada gamma* Fletcher paratype, in BMNH). UGANDA: Entebbe, Zika Forest, v. 1966, 1 ♂ (NMR, Bulawayo); Toro, Kibale Forest, v. 1966 (*R. H. Carcasson*), 1 ♂, 1 ♀ (NMK, Nairobi).

### *Zamarada subincoloris* Gaede

(Text-figs 372, 373; Pl. 77, figs 761, 762; Pl. 116, fig. 1048)

*Zamarada subincoloris* Gaede, 1915: 119, pl. 2, fig. 14. Holotype ♂, NIGERIA (MHNU, Berlin) [examined].

♂ genitalia (Pl. 116, fig. 1048; Text-figs 372, 373). Apex of uncus rounded. Ventral plate of gnathus broader than base of uncus, rounded apex shallowly incised medially. Valve finely tapered apicad, only sparsely and minutely scobinate; apical fourth incurved towards uncus, extremity then curved ventrad. Aedeagus tapered with a minute, thorn-like projection at one-half. Apical fourth of fulcrum dilate, dorsal surface with two parallel, coarsely serrate ridges.

♀ genitalia (Pl. 77, figs 761, 762). Lamella postvaginalis rounded, posterior margin deeply and narrowly incised medially. Smaller lamella antevaginalis uniformly and minutely scobinate, posterior margin shallowly incised.

Measurements. Fore wing: ♂ 15–19 mm; ♀ 16–18 mm. Antennal pectinations: ♂ 8 ×, ♀ 3 × diameter of shaft.

Similar in colour and pattern to *onycha*, differing in shorter wing-span and the narrower, slightly deeper distal extension of the hyaline area on each wing between veins  $M_3$  and  $Cu_{1b}$ . In structure the form of the finely tapered valve, the large ventral plate of the gnathus and the elaborately and coarsely serrate fulcrum in the male genitalia and the form of the sterigma in the female genitalia are diagnostic.

DISTRIBUTION. Nigeria, Cameroun, Gabon.

#### MATERIAL EXAMINED.

*Zamarada subincoloris* Gaede, holotype ♂, NIGERIA ('Sud Nigerien'): Opobo (*Schütze*), labelled 'subincoloris Gaede Type' in Gaede's handwriting. The specimen is the one figured by Gaede, matching exactly his illustration in the shape of the antennae and in the minor tears in each fore wing. The data cited by Gaede at the end of his original description (KAMERUN: Johann-Albrechts Höhe, 1.vi.1896 (*L. Conrad*t)) were evidently in error. Type in MNHU, Berlin.

NIGERIA: Lagos, vii. 1959 (*J. Boorman*), 1 ♂; Omo, vii. 1960 (*J. Boorman*), 1 ♂ (both BMNH); Opobo (*Schütze*), 2 ♂ (MNHU, Berlin); Warri, vii. 1897 (*Dr Roth*), 1 ♀; Old Calabar (*F. W. Sampson*), 1 ♂ (both BMNH); Old Calabar, 1 ♀ (UM, Oxford). CAMEROUN: 8 km N. d'Edea, 8–9.iv.1970 (*C. Herbulot*), 1 ♂, 1 ♀ (coll. Herbulot, Paris); Epulan, 26.v.1926 (*G. Schwab*), 1 ♂ (BMNH); Efulen, v, vi, x–xii (*H. L. Weber*), 7 ♂, 5 ♀ (CM, Pittsburgh); Lolodorf (*L. Conrad*t), 1 ♂ (BMNH).

GABON: Savanes de Mwadi, près du Iézé, 26.iii.1963, 1 ♂; Belinga, Grande Crête Sud, 900 m, 19.iii.1963, 1 ♂ (both *G. Bernardi*, in MBG, Paris); Wonga Wonghé, 12.ii.1967 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris).

### *Zamarada xyele* sp. n.

(Text-figs 374, 375; Pl. 118, fig. 1058)

♂ (Pl. 118, fig. 1058). Hyaline area of wings almost colourless, with only a weak tinge of yellow, posteriorly striate with pearl-grey and finely edged distally with dark brown; costa of fore wing yellow striate with brownish grey; discal spots on both fore and hind wings large, oval, pearl-grey edged with brown. Subterminal fascia dentate, yellowish brown (pl. 5, E8) slenderly edged distally with glossy buff, strongly marked in subcostal, discal and tornal areas; non-hyaline terminal area brownish grey (pl. 5, C2) proximad of subterminal fascia, brownish grey mixed with buff distad of it; termen slenderly yellowish brown broken by buff-marked veins; cilia chequered buff and grey. Underside of discal spots and proximal half of non-hyaline terminal area of each wing greyish brown; distal half of non-hyaline area of fore wing buff partially suffused with greyish brown, that of hind wing buff; cilia as on upperside.

♂ genitalia (Text-figs 374, 375). Uncus almost square in shape with a short, ventrally inclined projection from mid-apical margin. Ventral plate of gnathus very strongly sclerotized, apex shallowly bilobate. Apices of valves incurved towards uncus, each tipped with a short spine. Aedeagus with a minute, thorn-like projection at two-fifths. Apex of fulcrum broadened, shallowly bifurcate and coarsely scobinate.

♀ unknown.

Measurements. Fore wing: ♂ 18 mm. Antennal pectinations: ♂ 9 × diameter of shaft.

Distinguished in the *principis*-group by the large discal spot on the hind wing, by the admixture of buff colour in the distal half of the upperside of the non-hyaline terminal area of each wing and by the corresponding pale areas on the underside. In the male genitalia the form of the uncus, valve and fulcrum is diagnostic.

DISTRIBUTION. Ivory Coast, Nigeria.

Holotype ♂, IVORY COAST: Korhogo [9°22' N. 5°31' W.], viii. 1964 (*P. Griveaud*), in MNHN, Paris.

Paratype. NIGERIA: Kaduna, 28.ix.1970 (*H. Politzar*), 1 ♂ (BMNH).

### THE *AUROLINEATA*-GROUP

Characterized in the male genitalia by the form of the asymmetrical valves and of the aedeagus. Each valve is tapered apicad and curved towards the uncus; left valve usually scobinate in part, apex acicular; right valve less finely tapered, inner margin serrate in part; dorsal process dilate and setose near base, but without digitate projection. Short, longitudinal, scobinate ridge usually present along apical half of aedeagus. Fulcrum short and weakly sclerotized, extending only to tip of aedeagus, usually dilate at apex and setose. Uncus stout, usually shallowly bilobate. Ventral plate of gnathus well developed, minutely and densely



scobinate. Vesica without cornutus. Third abdominal sternite with transverse band of spines.

The male hind tibia is dilate with a tuft of buff hair-scales; tuft just subequal in length to tibia.

In the female genitalia the ductus bursae is sclerotized and is almost as long as the bursa copulatrix; the sterigma is turned to the left through 45–90 degrees; posterior margin of lamella postvaginalis with digitate projection.

#### KEY TO SPECIES

- |       |                                                                                                                                                                                                                                                                                                              |                             |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 1     | Uncus tapered to a point. Apex of fulcrum not dilate. Left valve sparsely scobinate. Hyaline area of wing white                                                                                                                                                                                              | <i>herbuloti</i> (p. 225)   |
| –     | Apex of uncus shallowly excavate. Apex of fulcrum dilate. Left valve markedly scobinate. Hyaline area of wings tinged with yellow or green                                                                                                                                                                   | 2                           |
| 2 (1) | Semicircular excavation of uncus extending across full width of its apical margin. Non-hyaline terminal area of each wing not excavate between veins $M_3$ and $Cu_{1b}$                                                                                                                                     | <i>clio</i> (p. 222)        |
| –     | Apical margin of uncus shallowly excavate in medial third only. Non-hyaline terminal area not so formed                                                                                                                                                                                                      | 3                           |
| 3 (2) | Apical margin of uncus shallowly excavate medially (Text-fig. 378). Hyaline area of wings tinged with yellowish green. Non-hyaline terminal area boldly and deeply excavate between veins $M_3$ and $Cu_{1b}$ (Pl. 116, fig. 1046).                                                                          | <i>aurolineata</i> (p. 223) |
| –     | Apical margin of uncus with two points medially and a very shallow depression between (Text-fig. 380). Hyaline area of wings duller yellow, copper-tinted in oblique light. Non-hyaline terminal area of each wing with shallow, lunulate excavation between veins $M_3$ and $Cu_{1b}$ (Pl. 118, fig. 1061). | <i>aerata</i> (p. 224)      |

#### *Zamarada clio* Oberthür

(Text-figs 376, 377; Pl. 78, figs 765, 766; Pl. 118, fig. 1063)

*Zamarada clio* Oberthür, 1912 : 257, 350, pl. 152, fig. 1456. LECTOTYPE ♂, CAMEROUN (BMNH), here designated [examined].

♂ ♀ (Pl. 118, fig. 1063). Hyaline area of wings tinged with green and very sparsely striate with brownish grey; distal margin crenulate and finely black; discal dots minute, black; costa of fore wing buff striate with brownish grey. Non-hyaline terminal area brownish orange (pl. 6, C4) suffused with brownish grey (pl. 6, C2), not excavate between veins  $M_3$  and  $Cu_{1b}$ ; dentate subterminal fascia reddish golden (pl. 6, C7) finely edged distally with glossy buff, the whole strongly marked and sharply defined; cilia buff suffused and chequered with greyish brown. Underside of non-hyaline terminal area and discal dots usually uniformly greyish brown; occasionally tinged with buff terminad.

♂ genitalia (Text-figs 376, 377). Apical margin of uncus excavate, excavation extending across full width of margin. Ventral plate of gnathus strongly sclerotized and minutely scobinate.

♀ genitalia (Pl. 78, figs 765, 766). Lamella antevaginalis strongly sclerotized and turned laterally through 90 degrees; operculum at left side covered with the slender, folded, tongue-like posterior extension of the lamella postvaginalis. Ductus bursae sclerotized, one-half as long as the membranous corpus bursae.

Measurements. Fore wing: ♂ 17.5–20.0 mm; ♀ 16.5–18.0 mm. Antennal pectinations: ♂ 8 ×, ♀ 1.5 × diameter of shaft.

Externally distinct in colour and pattern; *regularis* in the *flavicosta*-group, which it approaches in pattern, differs in its smaller size [wing-span 14–15 mm], its yellow cilia strikingly chequered at apex and between veins  $M_3$  and  $Cu_{1b}$  on each wing and the appreciably longer antennal pectinations in both sexes. In the male genitalia the form of the excavate uncus and in the female the form of the lamellae are diagnostic.

DISTRIBUTION. Cameroun, Gabon.

#### MATERIAL EXAMINED.

*Zamarada clio* Oberthür, lectotype ♂ here designated, CAMEROUN ('Kamerun'): Lolodorf, 1894–1895 (*L. Conradt*): '*Zamarada clio* Obthr.' [in Oberthür's handwriting]; black and white outline of fig. 1456: Geometridae genitalia slide no. 6355 in BMNH.

CAMEROUN: M'Balmayo, Ecole forestière, 11.ix.1971 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris); Epulan, iv. 1926 (*G. Schwab*), 2 ♂, 1 ♀; Sakbayeme, 5.x.1921 (*G. Schwab*), 1 ♂ (all BMNH); Efulen, i, iii–viii, x, xii (*H. L. Weber*), 15 ♂, 2 ♀ (CM, Pittsburgh); type locality, 2 ♂, 1 ♀ (*Zamarada clio* Oberthür, paralectotypes); Lolodorf, xi. 1901, 1 ♀ (all BMNH). GABON: Tchibanga, ix. 1952 (*P. Rougeot*), 1 ♂ (MNHN, Paris).

#### *Zamarada aurolineata* Gaede

(Text-figs 378, 379; Pl. 78, figs 767, 768; Pl. 116, fig. 1046)

*Zamarada aurolineata* Gaede, 1915 : 120, pl. 2, fig. 15. Holotype ♂, CAMEROUN (MNHU, Berlin) [examined].

♂ ♀ (Pl. 116, fig. 1046). Hyaline area of wings tinged with yellowish green, striate with brownish orange and finely edged distally with black; discal spots minute, black and sharply marked; costa of fore wing striate with grey. Non-hyaline terminal area brownish orange (pl. 6, C5–C6) overlaid in oblique light with purplish grey, boldly and deeply excavate between veins  $M_3$  and  $Cu_{1b}$ ; dentate subterminal fascia light brown (pl. 6, D8), strongly marked and finely edged distally with glossy buff. Underside of non-hyaline terminal area uniformly greyish brown.

Three examples from Fernando Po have the non-hyaline terminal area greyish orange (pl. 5, B4) distad of the dark brown subterminal fascia and brownish orange (pl. 5, C4) proximad of it. The underside of the non-hyaline terminal area is brownish orange darkening to greyish brown near costa. Further material may shew these differences to be subspecific.

♂ genitalia (Text-figs 378, 379). Closely similar to those of *clio*, differing in the broader uncus with its narrower and shallower medial excavation and in the form of the asymmetrical ventral plate of the gnathus.

♀ genitalia (Pl. 78, figs 767, 768). Distinguished from *clio* by the very slender, digitate projection from the posterior margin of the lamella postvaginalis.

Measurements. Fore wing: ♂ 18–21 mm; ♀ 18 mm. Antennal pectinations: ♂ 9 ×, ♀ 4 × diameter of shaft.

Similar in size and colour to *dilata* in the *acrochra*-group; distinguished in the male by the markedly less dilate hind tibia and in both sexes by the sharply marked, minute, black discal dots on the upper surface of the wings and by the uniformly

greyish brown underside of the non-hyaline terminal area. Distinguished from other species in the *aurolineata*-group by colour and wing-pattern and by the genitalic characters defined above.

DISTRIBUTION. Fernando Po, Cameroun, Gabon.

#### MATERIAL EXAMINED.

*Zamarada aurolineata* Gaede, holotype ♂, CAMEROUN ('Kamerun'): Yaoundé (Yaunde-Stat.), 31.v.1895 (*V. Carnap*), in MNHU, Berlin.

FERNANDO PO (*W. Cooper*), 3 ♂, 1 ♀. CAMEROUN: Yabassi Distr., lat. 4° N., long. 10° E., xii. 1937 (*F. G. Merfield*), 1 ♂, 1 ♀; Johann-Albrechts Höhe, 1898 (*L. Conradt*), 3 ♂, 1 ♀; Epulan, iv. 1926 (*G. Schwab*), 8 ♂, 5 ♀ (all BMNH); Efulen, i-xii (*H. L. Weber*), 53 ♂, 47 ♀ (monthly maximum, 11 ♂, 12 ♀ in vi) (all CM, Pittsburgh); Lolodorf, 1894-1895 (*L. Conradt*), 12 ♂, 7 ♀ (BMNH); Lolodorf, xii. 1914 (*J. A. Reis*), 1 ♂, 1 ♀ (CM, Pittsburgh). GABON: Abanga, 24.xi.1968 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris); Mouila, v. 1947 (*P. Rougeot*), 1 ♂ (MNHN, Paris).

#### *Zamarada aerata* sp. n.

(Text-figs 380, 381; Pl. 118, fig. 1061)

♂ (Pl. 118, fig. 1061). Hyaline area of wings dull yellow, irrorate with vinaceous grey and edged distally with very fine, parallel fasciae of yellow, dark brown and silvery grey; hyaline area copper-tinted in oblique light; costa of fore wing buff, striate with silvery grey; discal spots black, that on hind wing minute. Non-hyaline terminal area brownish orange (pl. 6, C5), shallowly excavate in lunulate form between veins  $M_3$  and  $Cu_{1b}$ , termen finely silvery grey; dentate subterminal fascia brown (pl. 6, D7), darkened in anterior half of fore wing and edged distally with glossy buff; cilia grey, paling to buff terminad, glossy. Underside of non-hyaline terminal area greyish brown, that of hind wing brownish orange.

♂ genitalia (Text-figs 380, 381). Closely similar to those of *clio* and *aurolineata*, differing in the very shallow medial excavation of the apical margin of the uncus.

♀ unknown.

Measurements. Fore wing: ♂ 18.0-18.5 mm. Antennal pectinations: ♂ 8 × diameter of shaft.

Colour and wing-pattern are diagnostic.

DISTRIBUTION. Cameroun, Gabon.

Holotype ♂, GABON: Belinga, Camp Central, 700 m, 14.v.1963 (*G. Bernardi*), in MBG, Paris.

Paratypes. CAMEROUN: Efulen, 10.i.1923 (*H. L. Weber*), 1 ♂; ibidem, 6.vi.1922, 1 ♂ (both CM, Pittsburgh). GABON: Savanes de Mwadi, près du Iézé, 26.iii.1963, 1 ♂; Belinga, Camp Central, 500 m, 22.iii.1963, 1 ♂; ibidem, 25.iii.1963, 1 ♂; holotype data, 1 ♂; Belinga, 800 m, Piste de Mwadi, 20.iii.1963, 2 ♂; Belinga, 900 m, Grande Crête Sud, 19.iii.1963, 1 ♂; ibidem, 29.iii.1963, 1 ♂; Belinga, 1000 m, N. Crête Sud, 19.iii.1963, 1 ♂ (all *G. Bernardi* in MBG, Paris); Mouila, 7.x.1964 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris).

*Zamarada herbuloti* sp. n.

(Text-figs 382, 383; Pl. 79, figs 769, 770; Pl. 119, fig. 1072)

♂ ♀ (Pl. 119, fig. 1072). Hyaline area of wings white; costa of fore wing and posterior margin of hind wing buff, irrorate with dark grey; discal spots rarely present, then black and minute. Non-hyaline terminal area of wings brown (pl. 6, E6-E7); subterminal fascia dark brown (pl. 6, F6) to black, ill-defined and parallel with straight distal margin of hyaline area on fore wing, strongly marked and dentate between costa and vein  $M_3$  and weakly marked at posterior margin on hind wing; subterminal fascia finely edged distally with glossy buff between costa and vein  $M_1$  on each wing; cilia brown. Underside of non-hyaline terminal area uniformly greyish brown.

♂ genitalia (Text-figs 382, 383). Distinguished from other species in the *aurolineata*-group by the form of the uncus, tapered to a point, by the symmetrical, scoop-like ventral plate of the gnathus and by the form of the fulcrum with its simple, non-dilate apex.

♀ genitalia (Pl. 79, figs 769, 770). Distinguished by the form of the sterigma, which is turned through 45 degrees instead of through 90 degrees, as in *clio* and *aurolineata*; the operculum is covered by a digitate projection extending anteriorly from the lamella postvaginalis.

Measurements. Fore wing: ♂ ♀ 15-16 mm. Antennal pectinations: ♂ 7 ×, ♀ 2 × diameter of shaft.

Colour and wing-pattern are diagnostic.

It is with pleasure that I name this handsome species in honour of Monsieur C. Herbulot, in token acknowledgement of his kindness in placing at my disposal material from his own collection and material that he borrowed for me from other collections in Europe.

DISTRIBUTION. Cameroun, Gabon.

Holotype ♂, GABON: Belinga, 800 m, Piste de Mwadi, 20.iii.1963 (*G. Bernardi*), in MBG, Paris.

Paratypes. CAMEROUN: Efulen, 6.iv.1923 (*H. L. Weber*), 1 ♀; ibidem, 9.v.1923, 1 ♂; 16.ix.1922, 1 ♀; 20.ix.1923, 1 ♂; 14.xi.1924, 1 ♂; 19.xii.1922, 1 ♂ (all CM, Pittsburgh). GABON: Belinga, 500 m, Camp Central, 3.iv.1963, 1 ♂; Belinga, 700 m, Camp Central, 20.iii.1963, 1 ♂; holotype data, 1 ♂, 1 ♀; Belinga, 900 m, Grande Crête Sud, 19.iii.1963, 2 ♀ (all *G. Bernardi*, in MBG, Paris).

THE *PERLEPIDATA*-GROUP

Characterized in the male genitalia by the form of the asymmetrical valves and the aedeagus. Apices of dorsal and ventral margins of valves produced in digitate or acicular form. Dorsal process of valve often broadened apicad, then finely tapered; a digitate, setose projection near base. Aedeagus with a lobe-like extension from base and a finely tapered apex; apical half strongly sclerotized along one side, sclerotized margin minutely serrate in part. Vesica occasionally with a small, scobinate cornutus. Uncus short and tapered; dorsal surface clothed with stout setae or spines. Ventral plate of gnathus developed, usually slender and scobinate.



In the female genitalia the sterigma is asymmetrical, the ductus bursae situate at the right side.

#### KEY TO SPECIES AND SUBSPECIES

- 1 Hyaline area of wings white without dark irroration. Large discal spot on fore wing and non-hyaline terminal area brownish grey to black . . . . . 2
- Wings not so coloured . . . . . 6
- 2 (1) Tegulae conspicuously light brown. Apical margin of left valve deeply excavate, excavation equal in depth to width of valve at point of cleavage  
*dolorosa* (p. 233)
- Tegulae brownish grey to black, concolorous with non-hyaline terminal area of wings. Apical margin of left valve straight or very shallowly excavate between spine-like extensions of ventral and dorsal margins, excavation equal in depth to one-eighth of width of valve at point of cleavage . . . . . 3
- 3 (2) Non-hyaline terminal area of fore wing not excavate between veins  $M_3$  and  $Cu_{1b}$ . Apical margin of left valve very shallowly excavate between spine-like apices of ventral and dorsal margins. Distribution: Sierra Leone to Ghana. . . . . *perlepidata* (p. 230)
- Non-hyaline terminal area of fore wing excavate between veins  $M_3$  and  $Cu_{1b}$ . Apical margin of left valve straight or slightly arched between spine-like apices of ventral and dorsal margins. Distribution: Nigeria to Angola, Zaire, Uganda . . . . . 4
- 4 (3) Non-hyaline terminal area deeply and broadly excavate on hind wing between vein  $M_3$  and anal angle; fore wing with lunulate excavation between veins  $M_3$  and  $Cu_1$  (Pl. 119, fig. 1068). Distribution: Uganda, Zaire, Angola  
*terpsichore aprica* (p. 232)
- Non-hyaline terminal area of hind wing not so patterned . . . . . 5
- 5 (4) Non-hyaline terminal area of each wing deeply excavate between veins  $M_3$  and  $Cu_{1b}$  (Pl. 119, fig. 1066). Distribution: Cameroun  
*terpsichore terpsichore* (p. 231)
- Non-hyaline terminal area of each wing with lunulate excavation between veins  $M_3$  and  $Cu_{1b}$  (Pl. 119, fig. 1067). Distribution: Nigeria  
*terpsichore compacta* (p. 232)
- 6 (1) Non-hyaline terminal area tinged with white and densely striate with olive brown. Non-hyaline terminal area uniformly brownish grey, not excavate between veins  $M_3$  and  $Cu_{1b}$  (Pl. 119, fig. 1071) . . . . . *vigilans* (p. 229)
- Hyaline area tinged with green. Non-hyaline terminal area of each wing excavate between veins  $M_3$  and  $Cu_{1b}$  . . . . . 7
- 7 (6) Left hand valve shorter than right; apex of dorsal margin inclined towards uncus and usually tipped with single spine. Discal spot on hind wing well developed . . . . . *collarti* (p. 228)
- Valves of equal length. Apex of dorsal margin of left valve incurved towards uncus, apical area scobinate and margin serrate. Discal spot on hind wing absent. . . . . *bonaberiensis* (p. 226)

#### *Zamarada bonaberiensis* Strand

(Text-figs 384, 385; Pl. 80, figs 773, 774; Pl. 120, fig. 1073)

*Zamarada bonaberiensis* Strand, 1915 : 177. LECTOTYPE ♂, CAMEROUN (DEI, Eberswalde), here designated [examined].

♂♀ (Pl. 120, fig. 1073). Hyaline area of wings slightly tinged with green, striate with grey in proximal half; costa of fore wing buff, striate with grey, densely in proximal three-fourths; discal spot on fore wing large and dark brown; discocellulars on hind wing very slenderly dark brown or unmarked. Non-hyaline terminal area of wings dark brown (pl. 7, F5); broken, dentate subterminal fascia light brown (pl. 6, D7) usually heavily suffused with dark grey to black and edged distally with glossy grey. Underside of non-hyaline terminal area and discal spot on fore wing uniformly greyish brown.

In some examples the non-hyaline terminal area is paler, brownish orange irrorate with dark brown, between vein  $M_3$  and the anal angle.

In the male the long hair scales of the coremata, often extruded from the tip of the abdomen, are buff. The femur is fringed with long, buff hair-scales and the tibia dilate with a tuft of long, buff hair-scales.

♂ genitalia (Text-figs 384, 385). Ventral plate of gnathus semi-circular and scobinate. Valves asymmetrical, but equal in length; dorsal margin of left valve serrate apicad and incurved towards uncus. Fulcrum usually slender and extending a little beyond apex of aedeagus, apical fourth coarsely scobinate; in some examples the apical area of the fulcrum is broadened. Vesica ornamented with a slender, scobinate band.

♀ genitalia (Pl. 80, figs 773, 774). Ductus bursae sclerotized and longitudinally ribbed; operculum at right hand side of sterigma; lamella antevaginalis with an almost square, sclerotized plate extending anteriorly.

Measurements. Fore wing: ♂ 18–20 mm; ♀ 15–18 mm. Antennal pectinations: ♂ 7 ×, ♀ 6 × diameter of shaft.

Distinguished from other species in the *perlepidata*-group by colour and pattern; from *collarti* by the absence of a well developed discal spot on the hind wing. Distinguished in the male from similarly patterned species in the *reflexaria*-group by the presence of a fringe of long, buff hair-scales on the femur. In the genitalia the form of the asymmetrical valves in the male and the form of the sterigma in the female are diagnostic.

DISTRIBUTION. Ivory Coast, Cameroun, Zaire, Uganda, W. Kenya.

#### MATERIAL EXAMINED.

*Zamarada bonaberiensis* Strand, lectotype ♂ here designated, CAMEROUN ('Kamerun'): Bonaberi, xi–xii. 1910 (*Hintz* coll. et ded.): '*Zamarada bonaberiensis* m. ♂ Strand det.: Dtsch. Entomol. Institut, Berlin': Photographed, BMNH neg. no. 47004, in DEI, Eberswalde.

IVORY COAST: Fouena, 16 km S. of Touba, 1600 ft, 5.iv.1926 (*C. L. Collenette*), 1 ♂ (BMNH). CAMEROUN: Fôret de Bafout-Nguemba, 8 km S.S.E. de Bamenda, 2000 m, 18.x.1971 (*P. Darge*), 1 ♂; Ewonda, route Buea-VHF transmitter on Mt Cameroun, 900 m, 23–27.x.1971 (*P. Darge*), 1 ♂, 1 ♀ (all coll. Herbulot, Paris); lectotype locality, 1 ♀ (*Zamarada bonaberiensis* Strand paralectotype, in DEI, Eberswalde). ZAIRE ('Belgian Congo'): Upper Congo, Yakusu (*K. Smith*), 1 ♂ (BMNH); N. Lac Kivu, Rwankwi, xi. 1947 (*J. V. Leroy*), 1 ♂ (MRAC, Tervuren). UGANDA: Bwamba Forest, 2500 ft, iii. 1948 (*J. G. Williams*), 1 ♂ (BMNH); Bwamba, vi. 1956, 1 ♂; Toro, Kibale Forest, v. 1966, 1 ♂; Masaka, Katera, Sango Bay, xi. 1960, 2 ♂ (all *R. H. Carcasson*, in NMK, Nairobi). KENYA: Kakamega Forest, 5200 ft, 10–13.vii.1960 (*A. C. Twomey*), 1 ♂ (CM, Pittsburgh); Kakamega,

iii. 1956 (*R. H. Carcasson*), 3 ♂; Malaba Forest, vi. 1957 (*C. R. Howard*), 1 ♂ (all NMK, Nairobi).

### *Zamarada collarti* Debauche

(Text-figs 386, 387; Pl. 80, figs 775, 776; Pl. 120, fig. 1075)

*Zamarada collarti* Debauche, 1938 : 52, pl. 1, fig. 17. Holotype ♂, ZAIRE (MRAC, Tervuren) [examined].

♂ ♀ (Pl. 120, fig. 1075). Hyaline area of wings weakly tinged with green, evenly striate with greyish orange and very finely edged distally with dark brown; discal spots grey ringed with brown, that on the fore wing the larger; costa of fore wing orange-grey (pl. 5, B2) to buff very sparsely striate with grey. Non-hyaline terminal area variable in colour, greyish orange (pl. 5, B3) varyingly suffused with dark blond (pl. 5, D4); broken, dentate subterminal fascia light brown (pl. 6, D7, raw sienna), sometimes obscured by dark blond suffusion; distal half of apical area often densely brownish grey (pl. 5, E2). Underside of non-hyaline terminal area greyish brown (Pl. 5, D3), correspondingly darker beneath the darker areas of the upperside.

The male hind tibia is simple.

♂ genitalia (Text-figs 386, 387). Closely similar to those of *bonaberiensis*; differing in the form of the apical area of the dorsal margin of the left valve, usually tipped with one spine instead of scobinate and serrate-edged, and in the absence of a cornutus on the vesica.

♀ genitalia (Pl. 80, figs 775, 776). Differing from *bonaberiensis* in the less extensively sclerotized ductus bursae and the broader plate extending anteriorly from the lamella antevaginalis.

Measurements. Fore wing: ♂ 15.0–18.5 mm; ♀ 16–18 mm. Antennal pectinations: ♂ 9 ×, ♀ 6 × diameter of shaft.

Externally similar to *euerces* in the *metrioscaphes*-group; distinguished by the browner colour of the non-hyaline terminal area of the wings, which lack the strong contrast between the dark subterminal fascia and the light grey ground colour of that species, and by the rounder, less ovate discal spot on the fore wing. Distinguished further in the male by the presence of a simple hind tibia and in the female by the longer antennal pectinations, which in *euerces* are only five times as long as the diameter of the shaft. Distinguished from both sexes of *bonaberiensis* by the presence of a well developed discal spot on the hind wing.

DISTRIBUTION. Kenya, Uganda, Tanzania, Zaire.

#### MATERIAL EXAMINED.

*Zamarada collarti* Debauche, holotype ♂, ZAIRE ('Belgian Congo'): Kivu, Kibati, 1900 m, 10–20.i.1934 (*G. F. de Witte*), in MRAC, Tervuren.

KENYA: Mt Kenya, 13–30.vi.1930 (*E. Barns*), 1 ♂ (BMNH); Njoro, xii–i (*Mrs Board*), 1 ♂ (NMK, Nairobi); Elgongebiet (*F. Bryk*), 1 ♀ (ZSBS, Munich); Kitale, ii. 1962 (*Mrs E. M. Dougall*), 1 ♂; ibidem, v–vi. 1962, 1 ♂ (both NMK, Nairobi). UGANDA: Masaka, Katera, Sango Bay, x. 1960 (*R. H. Carcasson*), 1 ♂; Kampala, 18.ix.1954 (*D. Sevastopulo*), 1 ♀ (both BMNH). TANZANIA: Mufindi, Iringa (*P. Burdon*), 2 ♂ (BMNH); Mt Rungue, 2600 m, 12.xi.1962 (*G. Heinrich*), 1 ♂ (ZSBS, Munich). ZAIRE: N.W. Kivu, Lake Mokoto Dist., 5000–7000 ft,

ix. 1921 (*T. A. Barns*), 1 ♂ (BMNH); N. Lac Kivu, Rwankwi, iv, ix, xii (*Mme J. V. Leroy*), 3 ♂ (MRAC, Tervuren).

### *Zamarada vigilans* Prout

(Text-figs 388, 389; Pl. 81, figs 777, 778; Pl. 119, fig. 1071)

*Zamarada vigilans* Prout, 1915 : 343. LECTOTYPE ♂, GHANA (BMNH), here designated [examined].

♂ ♀ (Pl. 119, fig. 1071). Hyaline area of wings tinged with white, having a pearl-grey glint in oblique light, and finely edged distally with dark brown, then silvery grey; medial and basal areas densely striate with olive-brown; discal spot on fore wing large and round, brownish grey with a pearl-grey medial line; discocellulars on hind wing usually unmarked; costa of fore wing buff densely striate with brownish grey. Non-hyaline terminal area uniformly brownish grey (pl. 6, E2) fading in older specimens to brown (pl. 6, E5), not excavate between veins  $M_3$  and  $Cu_{1b}$ ; dentate subterminal fascia of a darker shade, finely edged distally with silvery grey, but broken and ill-defined. Underside of non-hyaline terminal area and discal spot on fore wing uniformly brownish grey.

The male hind tibia is simple.

♂ genitalia (Text-figs 388, 389). Closely similar to those of *collarti*, differing slightly in the form of the asymmetrical valves and in the presence of a small scobinate cornutus on the vesica.

♀ genitalia (Pl. 81, figs 777, 778). Closely similar to those of *collarti*, differing in the smaller sclerotized plate, narrowed at base, extending anteriorly from the lamella antevaginalis.

Measurements. Fore wing: ♂ 14–16 mm; ♀ 13–16 mm. Antennal pectinations: ♂ 8 ×, ♀ 7 × diameter of shaft.

The colour and pattern of the wings are diagnostic.

DISTRIBUTION. Guinea, Ghana, Cameroun, Angola, Zaire, Uganda, W. Kenya.

#### MATERIAL EXAMINED.

*Zamarada vigilans* Prout, lectotype ♂ here designated, GHANA ('Gold Coast'): Bibiani (Bibianaha), 700 ft, 28.i.1912 (*H. G. F. Spurrell*), Geometridae genitalia slide 6337, in BMNH.

GUINEA: Massadou, near Macenta, 1600 ft, 13–17.v.1926 (*C. L. Collenette*), 1 ♂. GHANA: Juaso, 26.x.1938 (*G. S. Cansdale*), 1 ♂; lectotype locality, 1 ♂ (*Zamarada vigilans* Prout paralectotype, without abdomen). CAMEROUN: route Buea-VHF transmitter on Mt Cameroun, 900 m, 25.x.1970 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris); Bitje, Ja River, 2000 ft, dry season (*G. L. Bates*), 1 ♂ (BMNH). ANGOLA: Quiculungo, 120 km N. of Lucala, 800 m, iv. 1936 (*R. Braun*), 1 ♂. ZAIRE ('Belgian Congo'): Congo River below Stanleyville, v. 1920 (*T. A. Barns*), 1 ♂; W. Kivu, south side of Middle Lowa Valley, S. of Walikali, 3500 ft, forest, iii. 1924, wet season (*T. A. Barns*), 1 ♂; W. Kivu, Katana, 5–7000 ft, highland forest bordering pasture land, iv. 1924, beginning of wet season (*T. A. Barns*), 1 ♂ (all BMNH). UGANDA: Entebbe, Zika Forest, v–vii, 1961, 2 ♂ (NMR, Bulawayo); Jinja, Mabira Forest, x. 1962 (*R. H. Carcasson*), 1 ♂ (NMK, Nairobi); Kampala, 10.ix.1943



(*T. H. C. Taylor*), 1 ♂ (ARS, Kawanda). KENYA: Kakamega, iii. 1966 (*R. H. Carcasson*), 1 ♂ (NMK, Nairobi).

### *Zamarada perlepidata* (Walker)

(Text-figs 390, 391; Pl. 81, figs 779, 780; Pl. 119, fig. 1070; Map 5)

*Comibaena perlepidata* Walker, [1863] 1862 : 1565. Holotype ♀, SIERRA LEONE (BMNH) [examined].

*Zamarada perlepidata* (Walker); Swinhoe, 1904 : 518.

*Zamarada exquisita* Warren, 1909 : 115. Holotype ♀, SIERRA LEONE (BMNH) [examined].

*Zamarada perlepidata* (Walker); Prout, 1915 : 343 [synonymy].

*Zamarada perlepidata* (Walker); Herbulot, 1954 : 329.

♂ ♀ (Pl. 119, fig. 1070). Hyaline area of wings white finely edged distally with black, then with light grey; costa and large, round discal spot on fore wing brownish grey (pl. 6, F2) to black, otherwise immaculate. Proximal half of non-hyaline terminal area light brown (pl. 6, D8) varyingly suffused with brownish grey to black; hind wing usually clear light brown between costa and vein  $M_3$ . Distal half of non-hyaline terminal area brownish grey (pl. 6, F2) to black. Subterminal fascia not marked. Underside of non-hyaline terminal area and discal spot on fore wing uniformly brownish grey.

In the male the hind femur fringed with long, buff hair-scales; hind tibia with longitudinal, sclerotized fold, into which the femoral hair-scales appear to lie when the leg is folded.

♂ genitalia (Text-figs 390, 391). Ventral plate of gnathus very slender, rounded at apex. Juxta tapered. Valves asymmetrical. Vesica without cornutus.

♀ genitalia (Pl. 81, figs 779, 780). Ductus bursae ribbed and sclerotized; operculum at right side of asymmetrical sterigma. Lamella antevaginalis without sclerotized plate extending anteriorly.

Measurements. Fore wing: ♂ 15–17 mm; ♀ 14–16 mm. Antennal pectinations: ♂ 6 ×, ♀ 3 × diameter of shaft.

The colour and pattern of the wings are diagnostic. Distinguished from the similarly coloured *terpsichore* by the much straighter course of the distal margin of the hyaline area on the fore wing; from *dolorosa* by the presence of light brown colour in the proximal half of the non-hyaline terminal area of each wing.

DISTRIBUTION (Map 5). W. Africa, Guinea to Ghana.

#### MATERIAL EXAMINED.

*Comibaena perlepidata* Walker, holotype ♀, SIERRA LEONE: (*Rev. D. F. Morgan*), Geometridae genitalia slide no. 6340, in BMNH. *Zamarada exquisita* Warren, holotype ♀, SIERRA LEONE: Moyamba, v. 1903 (*D. Cator*), Geometridae genitalia slide no. 6342, in BMNH.

GUINEA: Soundedou, near Macenta, 1600 ft, 13.v.1926 (*C. L. Collenette*), 2 ♂; Massadou, near Macenta, 1600 ft, 13–17.v.1926 (*C. L. Collenette*), 1 ♂. SIERRA LEONE: Freetown, x–xii. 1968 (*D. F. Owen*), 8 ♂, 2 ♀ (all BMNH). LIBERIA: Nimba, Grassfield, vi–vii. 1967 (*A. Forbes-Watson*), 2 ♂ (NMK, Nairobi). IVORY COAST: Bingerville, vi, viii (*G. Melou*), 3 ♂, 3 ♀ (BMNH); Yapo-Sud, 22 km S.E. of Agboville, 12–18.iv.1969 (*C. Herbulot*), 1 ♂, 4 ♀ (coll. Herbulot, Paris). GHANA:

Juaso, 8.ii.1937 (*G. Cansdale*), 1 ♀; Takwa (*R. E. James*), 1 ♂; 20 miles W. & N.W. of Sekondi (*L. R. Tesch*), 1 ♀ (all BMNH).

***Zamarada terpsichore* Oberthür sp. rev.**

(Text-figs 392–394; Pl. 82, figs 781, 784, 785; Pl. 119, figs 1066–1068; Map 5)

*Zamarada terpsichore* Oberthür, 1912 : 258, 350, pl. 152, fig. 1461.

*Zamarada terpsichore* Oberthür; Prout, 1915 : 343. [Err. synonymy.]

♂ genitalia (Text-figs 392–394). Closely similar to those of *perlepidata*, differing in the form of the asymmetrical valves. In *perlepidata* the apical margin of the left valve is very shallowly excavate between the spined tip of the ventral margin and the bluntly produced tip of the dorsal margin. In *terpsichore* the apical margin of the left valve is straight or arched between the spined tips of the ventral and dorsal margins. Vesica without cornutus.

♀ genitalia (Pl. 82, figs 781, 784, 785). Closely similar to those of *perlepidata*, differing in the less extensive leftward lateral extension from the operculum of the sclerotized, asymmetrical lamella antevaginalis.

Colour of upper and under surfaces of wings similar to those of *perlepidata*. Three subspecies are recognized, differing in size and pattern; each differs from *perlepidata*, none having the almost straight distal margin of the white, hyaline area of the fore wing, characteristic of that species.

The male hind leg is similar to that of *perlepidata*.

Measurements. Fore wing: ♂ 15–17 mm; ♀ 14–17 mm. Antennal pectinations: ♂ ♀, 5 × diameter of shaft.

DISTRIBUTION (Map 5). Nigeria, Cameroun, Angola, Zaire, Uganda.

***Zamarada terpsichore terpsichore* Oberthür**

(Text-figs 392, 393; Pl. 82, figs 781, 784; Pl. 119, fig. 1066; Map 5)

*Zamarada tersichore* Oberthür, 1912 : 258, 350, pl. 152, fig. 1461. LECTOTYPE ♂, CAMEROUN (BMNH), here designated [examined].

♂ ♀ (Pl. 119, fig. 1066). Characterized by the deep excavation of the brownish grey to black non-hyaline terminal area between veins  $M_3$  and  $Cu_{1b}$  on each wing.

Measurements. Fore wing: ♂ 17 mm; ♀ 16 mm.

DISTRIBUTION (Map 5). Cameroun.

**MATERIAL EXAMINED.**

*Zamarada terpsichore* Oberthür, lectotype ♂ here designated, CAMEROUN ('Kamerun'): Lolodorf, 1894–1895 (*L. Conradt*): '*Zamarada terpsichore* Obthr.' [in Oberthür's hand-writing]: black and white outline of figure 1461: Geometridae genitalia slide no. 6344, in BMNH.

CAMEROUN: Johann-Albrechts Höhe, 1898 (*L. Conradt*), 2 ♀ (*Zamarada terpsichore*

Oberthür paralectotypes, in BMNH); Efulen, v, vi, x (*H. L. Weber*), 1 ♂, 2 ♀ (CM, Pittsburgh); Bitje, Ja River, 2000 ft, x-xi. 1912, 1 ♂; ibidem, dry season, 1 ♂.

***Zamarada terpsichore compacta* subsp. n.**

(Pl. 119, fig. 1067; Pl. 82, fig. 785; Map 5)

♂ ♀ (Pl. 119, fig. 1067). Distinguished from the nominate subspecies by the shallower excavation of the non-hyaline terminal area of each wing between veins  $M_3$  and  $Cu_{1b}$ ; the excavations are markedly lunulate in outline.

In the female genitalia (Pl. 82, fig. 785) the lateral extension of the lamella antevaginalis from the operculum is less strongly developed than in the nominate subspecies.

Measurements. Fore wing: ♂ 16 mm; ♀ 14-16 mm.

DISTRIBUTION (Map 5). Nigeria.

Holotype ♂, NIGERIA: south, Ilesha (*Capt. Humfrey*), Geometridae genitalia slide no. 6346, in BMNH.

Paratypes. NIGERIA: Yorubaland, Ogbomoso (*Carter*), 1 ♀; Lagos, Ebute Metta, 17.vii.1906 (*G. L. Boag*), 2 ♀; Ilesha (*Capt. Humfrey*), 1 ♀; Omo, vi. 1960 (*J. Boorman*), 1 ♂, 2 ♀.

***Zamarada terpsichore aprica* subsp. n.**

(Text-fig 394; Pl. 82, fig. 785; Pl. 119, fig. 1068; Map 5)

♂ ♀ (Pl. 119, fig. 1068). Distinguished by the pattern of excavation of the non-hyaline terminal area of the wings; shallow and lunulate between veins  $M_3$  and  $Cu_{1b}$  on the fore wing, broad and deep between vein  $M_3$  and the anal angle on the hind wing.

Measurements. Fore wing: ♂ ♀ 17 mm.

In the male genitalia (Text-fig. 394) the apical margin of the left valve is arched between the spined apices of the ventral and dorsal margins. In the female genitalia (Pl. 82, fig. 785) the form of the sterigma is similar to that of subsp. *compacta*.

DISTRIBUTION (Map 5). Uganda, Zaire, Angola.

Holotype ♂, UGANDA: Kawanda, m.v. light, 18-19.vii.1962, Geometridae genitalia slide no. 7745, in BMNH.

Paratypes. UGANDA: holotype data, 1 ♀ (ARS, Kawanda); Jinja, Mabira Forest, x. 1962 (*R. H. Carcasson*), 1 ♂; Kampala, Kabanyolo Farm, viii-x. 1965 (*W. Block*), 1 ♂, Entebbe, ii. 1962 (*D. Bartlett*), 1 ♂ (all NMK, Nairobi); Entebbe, Zika Forest, iv, vi, vii. 1961, 4 ♂ (NMR, Bulawayo).

Associated with subsp. *aprica*, but excluded from the type-series. ZAIRE ('Belgian Congo'): W. Kivu, near Masisi, Upper Lowa Valley, 5000-6000 ft, forest and long grass, ii. 1924, wet season (*T. A. Barns*), 1 ♂ (BMNH). ANGOLA: Prov. Nordcuanza, Canzele, 30 km N. of Quiculungo, 18.x.1957 (*G. Heinrich*), 2 ♂ (ZSBS, Munich).

*Zamarada dolorosa* sp. n.

(Text-figs 395, 396; Pl. 82, figs 782, 783; Pl. 119, fig. 1069)

♂ ♀ (Pl. 119, fig. 1069). Tegulae light brown (pl. 6, D6). Hyaline area of wings white, slenderly edged distally with black, then glossy grey; discal spot on fore wing black, glossy grey medially; costa of fore wing brownish grey striate with glossy grey; hyaline area otherwise immaculate. Non-hyaline terminal area of each wing uniformly brownish grey on upper and under surfaces.

The male hind leg is similar to those of *perlepidata* and *terpsichore*.

♂ genitalia (Text-figs 395, 396). Uncus tapered, rather longer and more strongly sclerotized than in preceding species in the group. Ventral plate of gnathus broad and scoop-like. Valves asymmetrical; apical margin of left valve deeply excavate, excavation equal in depth to width of valve at point of cleavage. Fulcrum a little dilate in apical half and scobinate.

♀ genitalia (Pl. 82, figs 782, 783). Ductus bursae weakly ribbed and sclerotized, joined to asymmetrical sterigma at right side. Lamella postvaginalis sclerotized as illustrated, with a strong disc-like plate at each side.

Measurements. Fore wing: ♂ ♀ 15–17 mm. Antennal pectinations: ♂ 7 ×, ♀ 6 × diameter of shaft.

Distinguished from the similarly coloured *perlepidata* and *terpsichore* by the uniformly brownish grey non-hyaline terminal area of each wing, which lacks the proximal light brown band found in those species, and by the presence of conspicuous, light brown rather than brownish grey tegulae. In the male genitalia the form of the deeply excavate apex of the left valve and in the female the strongly sclerotized pattern on the lamella postvaginalis are diagnostic.

DISTRIBUTION. Guinea, Liberia, Ghana, Cameroun, Gabon, Angola, Zaire.

Holotype ♂, GUINEA ('French Guinea'): Boukouni, near Macenta, 1750 ft, 11.v.1926 (C. L. Collenette), Geometridae genitalia slide no. 7741, in BMNH.

Paratypes. GUINEA: Massadou, near Macenta, 1600 ft, 13–17.v.1926 (C. L. Collenette), 1 ♂. LIBERIA: Nimba, Grassfield, vi–vii. 1967 (A. Forbes-Watson), 1 ♂. GHANA: Bibiani (Bibianaha), 23.x–2.xi.1911 (H. G. F. Spurrell), 1 ♀ (all BMNH). CAMEROUN: Massif du Manengouba, Piste Bakwat-Mwakoumel, 1240 m, 11–12.iv.1972, 1 ♂; N'Kolbisson, 7 km W. de Yaoundé, 700 m, 15–21.iv.1972, 3 ♂ (all C. Herbulot, in coll. Herbulot, Paris). GABON: Mouila (P. Rougeot), 1 ♀ (BMNH). ANGOLA: Prov. Nordcuanza, Canzele, 30 km nördl. Quiculungo, 18.x.1957 (G. Heinrich), 2 ♂ (ZSBS, Munich). ZAIRE ('Belgian Congo'): Kasai, Lodja, iii. 1959 (R. H. Carcasson), 1 ♀ (NMK, Nairobi).

## THE REFLEXARIA-GROUP

Moths in this group have the hyaline area of the wings slightly tinged with green; the non-hyaline terminal area on the fore wing and on the anterior half of the hind wing is dark brown; on the posterior half of the hind wing it is buff; the subterminal fascia is dark grey to black; discal spot on fore wing well developed, that on hind wing small or absent.

Characterized in the male genitalia by the form of the fulcrum, from which the strongly sclerotized slender core, acicular or tipped with several spines, curves



dorsad towards the aedeagus and the weakly sclerotized sheath, its margins sometimes serrate apicad, extends beyond the tip of the aedeagus. The uncus is short and tapered, the dorsal surface densely setose basad. Ventral plate of gnathus usually long, slender and scoop-like. Juxta bifurcate. Valves symmetrical, apex tapered, truncate or shallowly excavate. Vesica with or without cornuti.

The hind tibia in the male is dilate.

In the female genitalia two sclerotized plates, one at each side, extend posteriorly from the lamella antevaginalis; anteriorly these plates are fused with and overlaid by a strongly sclerotized, transverse plate.

*Z. ixiaria* Swinhoe is tentatively included in the group because of the form of the uncus, juxta and fulcrum.

#### KEY TO SPECIES AND SUBSPECIES

- |   |                                                                                                                                                                                                                                                                         |                                       |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| 1 | Non-hyaline terminal area of fore wing of even width. Apex of valve with two spatulate and smoothly sclerotized projections, that from apex of ventral margin short and broadly rounded, that from apex of dorsal margin longer, tapered and blade-like (Text-fig. 403) | <i>ixiaria</i> (p. 238)               |
| - | Non-hyaline terminal area of fore wing excavate between veins $M_3$ and $Cu_{1b}$ . Valve not so formed                                                                                                                                                                 | 2                                     |
| 2 | (1) Tip of curved, sclerotized core of fulcrum smoothly acicular; margins of sheath smooth apicad. Valve tapered                                                                                                                                                        | <i>rhamphis</i> (p. 234)              |
| - | Tip of curved, sclerotized core of fulcrum scobinate; margins of sheath serrate apicad. Valve truncate or apical margin shallowly excavate                                                                                                                              | 3                                     |
| 3 | (2) Apex of valve truncate (Text-fig. 399)                                                                                                                                                                                                                              | <i>cucharita</i> (p. 235)             |
| - | Apical margin of valve shallowly excavate (Text-fig. 401)                                                                                                                                                                                                               | 4                                     |
| 4 | (3) Non-hyaline terminal area of fore wing shallowly excavate in lunulate form between veins $M_3$ and $Cu_{1b}$ . Distribution: W. Africa                                                                                                                              | <i>reflexaria reflexaria</i> (p. 236) |
| - | Non-hyaline terminal area of each wing broadly and smoothly excavate between veins $M_3$ and $Cu_{1b}$ . Distribution: W. Kenya, Uganda, E. Zaire                                                                                                                       | <i>reflexaria aphis</i> (p. 237)      |

#### *Zamarada rhamphis* sp. n.

(Text-figs 397, 398; Pl. 83, figs 786, 787; Pl. 120, fig. 1074)

♂ ♀ (Pl. 120, fig. 1074). Hyaline area of wings tinged with yellowish green and finely edged distally with black and silvery grey; costa of fore wing buff striate with grey; posterior margin of each wing sparsely striate with light grey; discal spot on fore wing ovate, silvery grey outlined with dark grey; discocellulars on hind wing unmarked in male, but with a minute dot in female. Non-hyaline terminal area brownish orange (pl. 7, C4) proximad of dark grey to black, dentate subterminal fascia; fore wing and anterior half of hind wing suffused with grey distad of it, posterior half of hind wing buff. Underside of non-hyaline terminal area and discal spot on fore wing uniformly brownish grey.

Male hind tibia dilate enclosing a short tuft of light buff hair-scales, one-half as long as tibia.

♂ genitalia (Text-figs 397, 398). Juxta with two almost parallel, sclerotized bands. Valve tapered, ventral margin minutely crenulate apicad; short, crenulate, setose ridge on dorsal surface near base of dorsal margin; dorsal process with setose, digitate projection from basal

fourth. Tip of curved, sclerotized core of fulcrum smoothly acicular; margins of sheath smooth apicad. Vesica without cornutus.

♀ genitalia (Pl. 83, figs 786, 787). Lamella antevaginalis asymmetrical, fused with and overlaid by a broad, strongly sclerotized, transverse band (moved aside through about 45 degrees in figures to permit view of operculum); lamella postvaginalis strongly sclerotized, V-shaped. Posterior fourth of corpus bursae lightly sclerotized.

Measurements. Fore wing: ♂ 16 mm; ♀ 15.5–16.5 mm. Antennal pectinations: ♂ 8.5 ×, ♀ 4.5 × diameter of shaft.

Externally similar to West African *reflexaria* and also to *cucharita*, with which it occurs; distinguished from the latter in most examples by the larger discal spot on the fore wing and from both species in the male by the shorter tibial tuft. In the male genitalia the form of the tapered valve and of the smoothly acicular, arcuate core of the fulcrum and in the female genitalia the form of the asymmetrical sterigma are diagnostic.

DISTRIBUTION. Tanzania.

Holotype ♂, TANZANIA: Mal. Inst. Amani, xii. 1962 (*G. Pringle*), Geometridae genitalia slide no. 7777, in BMNH.

Paratypes. TANZANIA: Mal. Inst. Amani (*G. Pringle*), 2 ♂; E. Usambara Mts, Amani, ii. 1953 (*E. Pinhey*), 1 ♀; Tendaguru, 25.viii.1924 (*W. E. Cutler*), 1 ♀, all BMNH.

### *Zamarada cucharita* sp. n.

(Text-figs 399, 400; Pl. 83, figs 788, 789; Pl. 120, fig. 1076)

♂ genitalia (Text-figs 399, 400). Juxta shorter than in *rhamphis*, the sclerotized apices parallel. Valve truncate, ventral corner of apex sclerotized and thinly spatulate. Central sclerotized core of fulcrum arcuate and scobinate apicad; margins of sheath serrate in apical half.

♀ genitalia (Pl. 83, figs 788, 789). Sterigma symmetrical. Lamella antevaginalis fused with and overlaid by a broad, transverse, sclerotized band anteriorly; two weakly sclerotized plates, one at each side, extend posteriorly to rounded apices, the apical margins minutely serrate; posterior ventral margin of the operculum with medial point. Lamella postvaginalis membranous.

Measurements. Fore wing: ♂ 13–16 mm; ♀ 14–16 mm. Antennal pectinations: ♂ 8 ×, ♀ 5 × diameter of shaft.

Closely similar in colour and pattern to *rhamphis*, differing in the rather shorter wing-span and the usually smaller discal spot on the fore wing (Pl. 120, fig. 1076); males differ in having a longer tuft of hair-scales enclosed in the dilate hind tibia, the tuft being just subequal in length to the tibia. In the male genitalia the truncate form of the valve, which may usually be seen in the dry state, the form of the juxta and of the fulcrum and in the female genitalia the form of the sterigma are diagnostic.

DISTRIBUTION. Kenya, Uganda, Cameroun, Nigeria, Ghana, Ivory Coast, Liberia, Guinea.

Holotype ♂, TANZANIA: Mal. Inst. Amani (G. Pringle), Geometridae genitalia slide no. 7224, in BMNH.

Paratypes. KENYA: Kenya Coast, Shimba Hills, xii. 1961, 1 ♂, 1 ♀; Kenya Coast, Gazi Forest, iv. 1964, 1 ♂ (all R. H. Carcasson); Nyali, i.iii.1969 (D. G. Sevastopulo), 1 ♀; ibidem, ii.iv.1969, 1 ♂; 20.x.1969, 1 ♂; xii, 3 ♂, 1 ♀ (all BMNH). TANZANIA: Amani (G. Pringle), 1 ♂, 1 ♀ (BMNH); ibidem, xi. 1965 (R. H. Carcasson), 3 ♀ (NMK, Nairobi); ibidem, 21-30.iv.1969 (Watulege), 1 ♂ (coll. Herbulot, Paris). UGANDA: Kampala, vi. 1953 (D. G. Sevastopulo), 1 ♀ (BMNH). CAMEROUN: Efulen, 16.iii.1917 (H. L. Weber), 1 ♂ (CM, Pittsburgh). NIGERIA: Yaba, 3.vii.1913 (J. W. Scott Macfie), 1 ♀; Lagos, 2 ♀. GHANA: Kumasi (Coomassie), i. 1923 (N. E. Bell), 1 ♀. IVORY COAST: 1 ♂ (all BMNH); Lamto, 36 km N.N.W. of Tiassalé, 20-23.iv.1969, 2 ♂; Yapo-Sud, 22 km S.S.E. of Agboville, 12-18.iv.1969, 1 ♀ (all C. Herbulot, in coll. Herbulot, Paris). LIBERIA: Nimba, Grassfield, vii-viii. 1967 (A. Forbes-Watson), 1 ♂ (NMK, Nairobi). GUINEA: Beyla (Dr Mir. Mrázek), 2 ♂, 1 ♀ (MM, Brno); Tondon, Cercle de Dubreka (L. Labour), 1 ♂ (coll. Herbulot, Paris).

### *Zamarada reflexaria* (Walker)

(Text-figs 401, 402; Pl. 84, figs 790, 791; Pl. 120, figs 1078, 1080)

*Comibaena reflexaria* Walker, [1863] 1862 : 1565.

♂ genitalia (Text-figs, 401, 402). Similar to those of *rhamphis* and *cucharita*, differing in the shallowly excavate apical margin of the valve and in the form of the fulcrum, the arcuate central core of which is tipped with stout spines and has a claw-like appearance; the margins of its sheath are serrate apicad.

♀ genitalia (Pl. 84, figs 790, 791). Closely similar to those of *cucharita*, differing in the narrower transverse sclerotized band fused with and overlying the lamella antevaginalis, in the minutely serrate posterior margins of the two weakly sclerotized, ovate plates extending posteriorly from it and in the serrate apex of the posterior ventral margin of the operculum.

Measurements. Fore wing: ♂ 15-18 mm; ♀ 14.0-16.5 mm. Antennal pectinations: ♂ 7.5 ×, ♀ 4 × diameter of shaft.

Two subspecies are recognized, distinguished by colour and wing pattern; the nominate subspecies occurs in West Africa, from Guinea to Angola, subsp. *apsis* occurs in Eastern Zaire, Uganda and Western Kenya.

The male hind tibia is similar to that of *cucharita*.

DISTRIBUTION. W. Africa, Guinea to Angola, Zaire, Uganda, Kenya.

### *Zamarada reflexaria reflexaria* (Walker)

(Pl. 120, fig. 1078)

*Comibaena reflexaria* Walker, [1863] 1862 : 1565. Lectotype ♂, SIERRA LEONE (BMNH) [examined].

*Zamarada reflexaria* (Walker) Swinhoe, 1904 : 517. [Lectotype designation.]

♂ ♀. Closely similar in colour and pattern to *cucharita*. Hyaline area of wings striate with grey proximally, the grey having a purple tint in oblique light, and finely edged distally

with dark brown. Non-hyaline terminal area light brown (pl. 6, D<sub>5</sub>) to brownish orange (pl. 7, C<sub>4</sub>) proximad of dark brown, dentate subterminal fascia; suffused with dark brown distad of it, except between veins  $M_3$  and  $Cu_{1b}$  on the fore wing and posterior of vein  $M_3$  on the hind wing, where the non-hyaline area is buff.

In the male the subterminal fascia is strongly marked in the apical area of each wing and the tornal area of the hind wing and is finely edged distally with buff.

Measurements. Fore wing: ♂ 15–18 mm; ♀ 14–15 mm.

DISTRIBUTION. W. Africa, Guinea to Angola.

#### MATERIAL EXAMINED.

*Comibaena reflexaria* Walker, lectotype ♂, SIERRA LEONE, 42–31 [pres. by Revd. D. F. Morgan], without abdomen, in BMNH. Designated as 'type' by Swinhoe, 1904: 517.

Walker described *Comibaena reflexaria* from a series of four syntypes, two specimens from Sierra Leone, one from South Africa and one without data; each represents a different species. Swinhoe designated a male from Sierra Leone as type, tantamount to a lectotype designation; the female paralectotype from Sierra Leone is *Zamarada nasuta* Warren, the male paralectotype from South Africa is *Zamarada transvisaria* Guenée and the male paralectotype without data is *Zamarada corroborata* Herbulot.

GUINEA: N'zérékoré, 1900 ft, v–vi. 1926, 1 ♂; Macenta, 2000 ft, v. 1926, 1 ♂ (both C. L. Collenette, in BMNH); Beyla (*Dr Mir. Mrázek*), 2 ♂ (MM, Brno). SIERRA LEONE: Bo, vi. 1969 (*R. Revell*), 2 ♂; Freetown, xii. 1968 (*D. F. Owen*), 1 ♀; Moyamba (*D. Cator*), 1 ♀. IVORY COAST: Bingerville, viii, xii (*G. Melou*), 2 ♂, 1 ♀. GHANA: Ashanti, Juaso (*G. H. Gibbs*), 1 ♂; Bibiani (Bibianaha), 700 ft, 14.v.1912 (*H. G. F. Spurrell*), 1 ♀. S. NIGERIA (*C. King*), 1 ♂ (all BMNH). CAMEROUN: Efulen, 31.xii.1919 (*H. L. Weber*), 1 ♂ (CM, Pittsburgh); Johann-Albrechts Höhe, 1898 (*L. Conradt*), 1 ♀ (BMNH). ZAIRE ('Belgian Congo'): Boma, x. 1903 (*C. Christy*), 1 ♂ (BMNH); Sankaru, Lusambo, viii–ix. 1950 (*Dr Fontaine*), 1 ♂, 1 ♀; Sankaru, 21.viii.1950, 1 ♂ (all MRAC, Tervuren). ANGOLA: Quirimbo, 75 km E. of Amboim, 300 m, 7–12.v.1934 (*Dr K. Jordan*), 1 ♀.

#### *Zamarada reflexaria aphis* subsp. n.

(Pl. 120, fig. 1080)

Distinguished from the nominate subspecies by the more extensive striation of the hyaline area of each wing that is found in most examples, by the broader, more rounded excavation of the non-hyaline terminal area between veins  $M_3$  and  $Cu_{1b}$  and by the more extensive areas of greyish rather than yellowish buff at mid-termen of fore wing and along the posterior half of the termen on the hind wing.

Measurements. Fore wing: ♂ 15.5–17.5 mm; ♀ 15.0–16.5 mm.

DISTRIBUTION. Zaire, Uganda, Kenya.

Holotype ♂, KENYA: Kakamega, iii. 1966 (*R. H. Carcasson*), in BMNH.

Paratypes. KENYA: holotype data, 1 ♂ (NMK, Nairobi); Kakamega, Kaimosi,



iv. 1952 (*E. Pinhey*), 1 ♀ (BMNH); Kakamega, v. 1964 (*T. H. E. Jackson*), 1 ♂ (NMK, Nairobi); Kakamega Forest, 5200 ft, 10-13.vii.1960 (*A. C. Twomey*), 5 ♂, 1 ♀ (CM, Pittsburgh); Malaba Forest, vi. 1957 (*C. R. Howard*), 1 ♂ (NMK, Nairobi).

Associated with subsp. *apsis*, but excluded from the type-series. UGANDA: Jinja, Mabira Forest, x. 1962 (*R. H. Carcasson*), 2 ♂ (NMK, Nairobi); Kampala, 26.vi.1953 (*D. G. Sevastopulo*), 1 ♂ (BMNH); Entebbe, Zika Forest, vi. 1961, 2 ♂ (NMR, Bulawayo); Entebbe, xi. 1961 (*E. S. Brown*), 1 ♀; Masaka, Katera, Sango Bay, x. 1960 (*R. H. Carcasson*), 2 ♂ (all NMK, Nairobi); Ankole, Kalinzu Forest, xi. 1961 (*R. H. Carcasson*), 1 ♂ (BMNH), 1 ♂ (NMK, Nairobi); Toro, Bwamba, ix. 1961 (*N. Mitton*), 1 ♂ (NMK, Nairobi). ZAIRE: N. Lac Kivu, Rwankwi, iii. 1952 (*J. V. Leroy*), 1 ♂; ibidem, 19.viii.1957, 1 ♂ (both MRAC, Tervuren).

### *Zamarada ixiaria* Swinhoe

(Text-figs 403, 404; Pl. 84, figs 792, 793; Pl. 120, fig. 1079)

*Zamarada ixiaria* Swinhoe, 1904 : 517. Holotype ♀, SIERRA LEONE (BMNH) [examined].

♂ ♀ (Pl. 120, fig. 1079). Hyaline area of wings tinged with greenish yellow, sparsely striate with grey and finely edged distally with black; distal margin on fore wing evenly lunulate, but not excavate, between veins  $M_3$  and  $Cu_{1b}$ ; discal spot on fore wing slender, pale grey. Non-hyaline terminal area light brown (pl. 6, D<sub>4</sub>) suffused with dark brown, except medially on fore wing and posteriorly on hind wing; dentate subterminal fascia dark brown slenderly edged distally with buff, heavily marked on fore wing and anteriorly on hind wing, slender and brownish orange on posterior half of hind wing. Underside of non-hyaline terminal area greyish brown.

The male hind femur is densely fringed with long, buff hair-scales; the hind tibia is grossly dilate enclosing a dense tuft of long hair-scales.

♂ genitalia (Text-figs 403, 404). Uncus with a pair of weakly developed, setose lateral processes. Ventral plate of gnathus semi-circular, scoop-shaped. Juxta bifurcate, the arms diverging in V-form. Valves with spatulate, sclerotized projection from ventral and dorsal apices, that from the former short and broadly rounded, that from the latter tapered and blade-like. Fulcrum with densely spined, arcuate central core extending from short sheath. Vesica with a cornutus consisting of a cluster of short spines.

♀ genitalia (Pl. 84, figs 792, 793). Sterigma asymmetrical. Lamella antevaginalis fused with and overlaid by a sclerotized plate, scobinate along its dorsal margin. Lamella postvaginalis strongly sclerotized, bilobate.

Measurements. Fore wing: ♂ 17-19 mm; ♀ 16-17 mm. Antennal pectinations: ♂ 9 ×, ♀ 6 × diameter of shaft.

Distinguished externally by colour and by the pattern of the fore wing, notably by the lunulate, almost straight distal margin of the hyaline area, and in the male by the structure of the hind tibia. In the male genitalia the form of the apical projections from the valve and the form of the fulcrum and in the female the form of the sterigma are diagnostic.

DISTRIBUTION. W. Africa, Guinea to Gabon, Fernando Po.

#### MATERIAL EXAMINED.

*Zamarada ixiaria* Swinhoe, holotype ♀, SIERRA LEONE: Port Lokko (*F. S. Penny*), Geometridae genitalia slide no. 6349, in BMNH.

GUINEA: Beyla (*Dr Mir. Mrázek*), 1 ♂, 4 ♀ (MM, Brno). SIERRA LEONE: Wilberforce, 2 miles S. of Freetown, 3-400 ft (*C. A. Forster*), 1 ♂ (UM, Oxford); Freetown, x-xii. 1968 (*D. F. Owen*), 3 ♂, 1 ♀; Bo, 22.xii.1957 (*R. Taylor*), 1 ♂; ibidem, vi, x (*R. Revell*), 1 ♂, 1 ♀ (all BMNH). LIBERIA: Marshall Terr., Harbel, i-iv, ix-xii (*R. M. Fox*), 9 ♂, 1 ♀ (CM, Pittsburgh); Nimba, Grassfield, vi-vii (*A. Forbes-Watson*), 1 ♂ (NMK, Nairobi). IVORY COAST: Bingerville, vi-xi (*G. Melou*), 9 ♂, 6 ♀. NIGERIA: Mambilla Plateau, Karmantan Forest, 5500 ft, 10.xii.1968 (*H. Roberts*), 1 ♂; Ilesha (*Humfrey*), 2 ♀; Degama (*Dr Ansorge*), 1 ♀. CAMEROUN: Savanes d'Akak, 14 km N.N.E. of Yaoundé, 28.viii.1971 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris); Bitje, Ja River, 2000 ft, iv-v. 1907, smaller rains (*G. L. Bates*), 1 ♂ (BMNH); Efulen, iv, v, x (*H. L. Weber*), 3 ♂ (CM, Pittsburgh). FERNANDO PO (*W. Cooper*), 2 ♂ (BMNH). GABON: Mouila, 30.ix.1964 (*P. Darge*), 1 ♀ (coll. Herbulot, Paris). ZAIRE ('Belgian Congo'): W. Kivu, south side Middle Lowa Valley, S. of Walikali, 3500 ft, forest, iv. 1924, wet season (*T. A. Barns*), 1 ♂ (BMNH).

### THE *TRIANGULARIS*-GROUP

Externally similar to species in the *reflexaria*-group. Characterized in the male genitalia by the symmetrical, bifurcate valves; the extended dorsal margin of each is tapered and usually smooth, though sometimes irregularly margined; the extended ventral margin is rounded at tip. The uncus is similar to that of the *reflexaria*-group; ventral plate of gnathus slender and minutely scobinate, apex narrowly rounded; juxta weakly developed; aedeagus tapered or blade-like; fulcrum slender, longer than aedeagus, the tip minutely scobinate.

The male hind tibia is dilate.

In those species in which the female is known, the operculum is U-shaped with crenulate edges. The lamella antevaginalis consists of a strongly sclerotized plate, transversely ridged or crenulate-edged. Ductus bursae broadened posteriorly, lateral apices finely tapered.

Four species are included in the group; a further five species from West African localities are represented in the BMNH, but material available for study is inadequate for description.

### KEY TO SPECIES

- |       |                                                                                                                                                                                                                                        |                           |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| 1     | Apical extension of ventral margin of valve straight, one-third as broad as long (Text-figs 409, 411)                                                                                                                                  | 2                         |
| -     | Apical extension of ventral margin of valve incurved towards uncus, two-thirds as broad as long (Text-figs 405, 407)                                                                                                                   | 3                         |
| 2 (1) | Apical extension of dorsal margin of valve one-half as long as that of ventral margin (Text-fig. 409). Hyaline area of wings tinged with light buff; distal margin on fore wing straight                                               | <i>crenulata</i> (p. 241) |
| -     | Apical extension of dorsal margin of valve equal in length to that of ventral margin (Text-fig. 411). Hyaline area of wings tinged with greenish yellow, distal margin on each wing broadly excurved between veins $M_3$ and $Cu_{1b}$ | <i>erosa</i> (p. 242)     |

- 3 (1) Vesica with two scobinate areas, each as long as width of aedeagus *triangularis* (p. 240)  
 - Vesica without cornutus . . . . . *amymone* (p. 241)

*Zamarada triangularis* Gaede

(Text-figs 405, 406; Pl. 121, figs 1081, 1082)

*Zamarada triangularis* Gaede, 1915: 120, pl. 2, fig. 16. Holotype ♂, CAMEROUN (MHNU, Berlin) [examined].

♂ (Pl. 121, figs 1081, 1082). Hyaline area of wings weakly tinged with greyish yellow, sparsely striate with grey in basal half of hind wing and in posterior basal half of fore wing and finely edged distally with dark brown and silvery grey; discal spot on fore wing glossy grey edged with dark brown, that on hind wing minute or absent. Non-hyaline terminal area light brown (pl. 6, D5) sparsely striate with dark brown; dentate subterminal fascia dark brown and finely edged distally with glossy grey, heavily marked on fore wing and anterior of vein  $M_3$  on hind wing; posterior of vein  $M_3$ , subterminal fascia on hind wing slender and broken and the area distad of it is buff irrorate with light brown; termen very finely dark brown; cilia chequered grey and greyish yellow. Underside of non-hyaline terminal area uniformly greyish brown.

In the holotype the intrusion of the hyaline into the non-hyaline terminal area of the fore wing is more extensive than in the other examples studied (Pl. 121, fig. 1081).

The hind tibia is dilate enclosing a dense tuft of long hair-scales three-fourths as long as the tibia.

♂ genitalia (Text-figs 405, 406). Apex of uncus slender and tapered. Juxta weakly sclerotized. Valves bifurcate; apical extension of ventral margin short and stout, two-thirds as broad as long, and incurved towards uncus apicad, extension with short, longitudinal ridge dorsally; dorsal process with triangular, setose projection near base. Aedeagus smooth and blade-like. Vesica with two cornuti, each a scobinate area as long as width of aedeagus.

♀ unknown.

Measurements. Fore wing: ♂ 16.5–19.5 mm. Antennal pectinations: ♂ 7 × diameter of shaft.

Externally similar to the nominate subspecies of *reflexaria*, differing in its slightly larger size and rather darker, more heavily patterned non-hyaline terminal area of the fore wing. In the male genitalia the form of the bifurcate valve and the presence of two scobinate cornuti on the vesica are diagnostic.

DISTRIBUTION. Ivory Coast, Cameroun, Gabon.

MATERIAL EXAMINED.

*Zamarada triangularis* Gaede, holotype ♂, CAMEROUN ('Neu Kamerun'): Bagiri, Galeriewald, 22.v.1913 (*Dr Houy*), in MNHU, Berlin.

IVORY COAST: Bingerville, viii. 1914 (*G. Melou*), 4 ♂ (BMNH); Yapo-Sud, 22 km S.S.E. of Agboville, 12–18.iv.1969 (*C. Herbulot*), 1 ♂. CAMEROUN: M'Balmayo, Ecole forestière, 11.ix.1971 (*P. Darge*), 3 ♂ (all coll. Herbulot, Paris); Johann-Albrechts Höhe, 1.vi.1896 (*L. Conradt*), 1 ♂ (MNHU, Berlin); 8 km N. d'Edea, 8–9.iv.1970 (*C. Herbulot*), 1 ♂ (coll. Herbulot, Paris); Efulen, iv, viii–xii (*H. L. Weber*), 7 ♂ (CM, Pittsburgh). GABON: Abanga, 24.xi.1968, 1 ♂; Mouila, 2.ix.1964, 1 ♂ (both *P. Darge*, in coll. Herbulot, Paris).

*Zamarada amymone* Prout

(Text-figs 407, 408; Pl. 121, fig. 1084)

*Zamarada amymone* Prout, 1934a : 96. Holotype ♂, ZAIRE (MRAC, Tervuren) [examined].♂ (Pl. 121, fig. 1084). Similar in colour, pattern and leg structure to *triangularis*, but distinguished by the minute size of the discal spot on the fore wing.♂ genitalia (Text-figs 407, 408). Closely similar to those of *triangularis*, differing in the shorter, stouter uncus, the slightly larger, scobinate ventral plate of the gnathus and in the absence of cornuti from the vesica.

♀ unknown.

Measurements. Fore wing: ♂ 16–18 mm. Antennal pectinations: ♂ 10 × diameter of shaft.

DISTRIBUTION. Guinea, Sierra Leone, Ivory Coast, Zaire, Uganda.

## MATERIAL EXAMINED.

*Zamarada amymone* Prout, holotype ♂, ZAIRE ('Belgian Congo'): Ituri, Kaporata, i.vii.1932 (L. Burgeon), in MRAC, Tervuren.

GUINEA: Macenta, 2000 ft, v. 1926 (C. L. Collenette), 1 ♂. SIERRA LEONE: Freetown, xi. 1968 (D. F. Owen), 1 ♂ (both BMNH). IVORY COAST: Lamto, 36 km N.N.W. of Tiassalé, 20–23.iv.1969 (C. Herbulot), 1 ♂ (coll. Herbulot, Paris). UGANDA: Masaka, Katera, Sango Bay, x. 1960 (R. H. Carcasson), 2 ♂.

*Zamarada crenulata* sp. n.

(Text-figs 409, 410; Pl. 85, figs 794, 795; Pl. 121, fig. 1083)

♂♀ (Pl. 121, fig. 1083). Thorax and abdomen buff, irrorate with grey, except on terminal segments. Hyaline area of wings tinged with light buff and sparsely striate with grey along posterior margins; a short, black fascia at base of hind wing; costa of fore wing light buff, striate with light grey near apex and with dark grey and black near base; discal spots black, that on fore wing larger and edged distally with grey and buff; distal margin of hyaline area slenderly black and glossy grey, almost straight on fore wing. Posterior half of non-hyaline terminal area of hind wing light buff finely edged proximally with brown (pl. 7, D7) and spotted interneurally with black along termen. On remainder of non-hyaline terminal area of hind wing and on that of fore wing the dentate subterminal fascia is black and heavily marked, finely edged distally with silvery grey and broadly bordered proximally with brown; wings buff suffused with dark grey and black distad of subterminal fascia; cilia dark grey spotted with buff, especially in the discal area of the fore wing. Underside of non-hyaline terminal area buff in posterior half of hind wing and terminally in discal area of fore wing; remainder dark grey.

The male hind tibia is dilate enclosing a tuft of hair-scales one-half as long as tibia.

♂ genitalia (Text-figs 409, 410). Uncus and ventral plate of gnathus similar to those of *amymone*. Apical extension of ventral margin of bifurcate valve one-third as broad as long, straight and slender to rounded tip; apical extension of dorsal margin one-half as long as that from ventral margin. Central sclerotized core of fulcrum sinuous and scobinate at tip, extending beyond the broad sheath enclosing its basal three-fourths. Vesica without cornutus.



♀ genitalia (Pl. 85, figs 794, 795). Lateral and posterior margins of lamella antevaginalis crenulate and coarsely scobinate, posterior margin incised medially at operculum.

Measurements. Fore wing: ♂ ♀ 17 mm. Antennal pectinations: ♂ ♀ 11 × diameter of shaft.

Externally distinct in both colour and pattern. In the male genitalia the form of the apical extensions of the bifurcate valve are diagnostic; in the female genitalia the crenulate and coarsely scobinate sterigma is strikingly formed and, when those of the other species in the group are known, may prove to be specifically diagnostic.

Holotype ♂, CAMEROUN: 8 km N. d'Edea, 10.iv.1970 (C. Herbulot), in coll. Herbulot, Paris.

Paratype. CAMEROUN: 8 km N. d'Edea, 30.iii.1970 (C. Herbulot), 1 ♀, in coll. Herbulot, Paris.

### *Zamarada erosa* sp. n.

(Text-figs 411, 412; Pl. 85, figs 796, 797; Pl. 120, fig. 1077)

♂♀ (Pl. 120, fig. 1077). Hyaline area of wings tinged with greenish yellow and sparsely striate with grey; distal margin of area broadly excurved between veins  $M_3$  and  $Cu_{1b}$  and finely edged with black; discocellulars grey, slender on hind wing, ringed with dark grey on fore wing. Non-hyaline terminal area of fore wing and anterior half of that area on hind wing greyish brown to light brown (pl. 6, D3-D4); posterior half of non-hyaline terminal area on hind wing greyish buff; subterminal fascia light brown (pl. 6, D6, cinnamon) edged distally with black, heavily marked between costa and vein  $M_2$  on fore wing, and finely with silvery grey, the silvery grey suffusing to termen on fore wing between veins  $M_3$  and  $Cu_{1a}$ . Underside of non-hyaline terminal area greyish brown, posterior half of hind wing a little paler.

The male hind tibia is dilate enclosing a tuft of hair-scales little longer than the width of the tibia; similar to those found in the *metrioscaphes*-group.

♂ genitalia (Text-figs 411, 412). Closely similar to those of *crenulata*, differing in the longer extension of the dorsal margin of the valve, being equal in length to that from the ventral margin, in the larger setose projection from near the base of the dorsal process of the valve and in the differently shaped fulcrum.

♀ genitalia (Pl. 85, figs 796, 797). Lamella antevaginalis ridged laterally and minutely scobinate along posterior margin.

Measurements. Fore wing: ♂ 18.5–21.0 mm; ♀ 18–19 mm. Antennal pectinations: ♂ 10 ×, ♀ 9 × diameter of shaft.

Distinguished externally from *triangularis*, *amymone* and *crenulata* by wing pattern, which is reminiscent of *collarti* in the *perlepidata*-group and of *reflexaria aphis* in the *reflexaria*-group, with which it occurs in western Kenya. Distinguished from both by the greater wing-span and lack of dark striation of the hyaline area; from *collarti* further by the presence of a pocket of hair-scales on the male hind tibia and from *reflexaria aphis* by the shorter hair-tuft on the male hind tibia and by the presence of a well-developed discal spot on the hind wing. In the male genitalia the form of the valve and of the fulcrum are diagnostic; in the female genitalia the form of the sterigma appears to be distinctive.

Three examples from Uganda, Cameroun and Nigeria have a shorter wing-span

(16.5–18.5 mm) and a less boldly excurved hyaline area between veins  $M_3$  and  $Cu_{1b}$ , but the genitalia are identical with those from W. Kenya. These examples, which may represent a subspecies, are associated with *erosa*, but are excluded from the type-series.

DISTRIBUTION. W. Kenya, Uganda, Cameroun.

Holotype ♂, KENYA: Malaba Forest, vi. 1957 (*C. R. Howard*), Geometridae genitalia slide no. 7797, in BMNH.

Paratypes. KENYA: holotype data, 1 ♂ (BMNH); Kakamega, iii. 1966 (*R. H. Carcasson*), 2 ♂ (NMK, Nairobi); Kakamega, vi. 1931 (*T. H. E. Jackson*), 1 ♀ (BMNH); Kakamega Forest, 5200 ft, 10–13.vii.1960 (*A. C. Twomey*), 1 ♂ (CM, Pittsburgh); Mt Elgon, 10.xi.1930 (*T. H. E. Jackson*), 1 ♀; ibidem, xi. 1958, 1 ♂ (both BMNH); Kitale, Kaptagat, 31.iii.1948 (*Walter*), 1 ♂ (NMK, Nairobi).

Other material, excluded from type-series: UGANDA: Bwamba Forest, ix. 1961 (*N. Mitton*), 1 ♂. CAMEROUN: Massif du Manengouba, Piste Bakwat-Mwakoumel, 1240 m, 11–12.iv.1972, 1 ♂; Préfecture de Kumba, 5 km E. de Oku, 2120 m, 8–9.iv.1972, 1 ♂ (both *C. Herbulot*, in coll. Herbulot, Paris); between Kumbo and Bamenda, 4000 ft, viii. 1922, 1 ♂; Genderu Mts, 4600 ft, ix. 1921, 1 ♂ (both BMNH).

### THE *PRISTIS*-GROUP

Characterized externally by colour and pattern; the orange-grey, non-hyaline terminal area is broadly and deeply excavate between veins  $M_3$  and  $Cu_{1b}$ ; the dark brown to black subterminal fascia is very strongly marked in the anterior half of each wing and diffuse distad in the discal area of the fore wing. Characterized in the male genitalia by the presence of four processes arising from the apex of each valve, two from the apex of the ventral margin and two from the apex of the dorsal margin; dorsal surface and dorsal margin of valve densely setose; uncus slender and tapered from a broad base with a pair of rounded, setose projections, one at each side; ventral plate of gnathus shallow, apex rounded; aedeagus with smooth, digitate projection at one-half; fulcrum of even width, one margin serrate in apical half; vesica with a minutely scobinate, longitudinal band.

In the male the hind femur is fringed with long, buff hair-scales; hind tibia fringed with long, dark grey hair-scales, grossly dilate, irrorate on outer surface with dark grey and enclosing a dense tuft of hair-scales.

### KEY TO SPECIES

- 1 Twin processes extending from apex of dorsal margin of valve slender and of equal length (Text-fig. 413). Distribution: Cameroun . . . *pristis* (p. 244)
- Twin processes extending from apex of dorsal margin of valve dissimilar, one short, straight and acicular, the other twice as broad, three times as long and coarsely scobinate, the apex acicular and incurved towards uncus (Text-fig. 415). Distribution: Liberia . . . *anna* (p. 244)

*Zamarada pristis* sp. n.

(Text-figs 413, 414; Pl. 115, fig. 1039)

♂ (Pl. 115, fig. 1039). Hyaline area of wings tinged with yellow, sparsely striate with brown proximally and posteriorly and finely edged distally with dark brown; discal spots on fore wing brown; discocellulars unmarked on hind wing. Non-hyaline terminal area brownish orange (pl. 5, C<sub>5</sub>-C<sub>6</sub>); dentate subterminal fascia brown to black, strongly marked anterior of vein  $M_3$  and posterior of vein  $Cu_{1b}$  on each wing and edged distally with glossy buff; each wing suffused with dark grey in discal area between subterminal fascia and termen. Underside of non-hyaline terminal area greyish orange; proximal half of area suffused with greyish brown on fore wing, the suffusion extending to distal margin in discal area; proximal half of area on hind wing similarly suffused between costa and vein  $M_3$ .

♂ genitalia (Text-figs 413, 414). Valves symmetrical; apex of ventral margin produced to narrowly rounded, membranous apex with a long, slender, sclerotized, acicular process adjacently situate; two strongly sclerotized processes of equal length at apex of dorsal margin.

♀ unknown.

Measurements. Fore wing: ♂ 17-18 mm. Antennal pectinations: ♂ 7 × diameter of shaft.

Similar to South African *transvisaria* in the *polycitemon*-group in colour and pattern of non-hyaline terminal area of wings, but distinguished by the straighter termen and more acutely angled apex of the fore wing, by the presence of a large discal spot on the fore wing and the unmarked discocellulars on the hind wing; the male is further distinguished by the grossly dilate hind tibia. In the male genitalia the form of the valve and aedeagus is diagnostic.

DISTRIBUTION. Cameroun.

Holotype ♂, CAMEROUN ('Kamerun'): Efulen, 6.vi.1922 (H. L. Weber), in CM, Pittsburgh.

Paratypes. CAMEROUN ('Kamerun'): Efulen, 11.i.1923 (H. L. Weber), 1 ♂; ibidem, without date, 1 ♂ (both CM, Pittsburgh).

*Zamarada anna* sp. n.

(Text-fig. 415; Pl. 115, fig. 1040)

♂ (Pl. 115, fig. 1040). Closely similar in colour and pattern to *pristis*. Distinguished externally by the reduction in size of the discal spot on the fore wing to a slender grey marking on the discocellulars and by the deeper excavation of the non-hyaline terminal area in the posterior half of the hind wing. The underside of the non-hyaline terminal area is more extensively suffused with greyish brown on the fore wing than in *pristis*, only the terminal margin remaining greyish orange.

♂ genitalia (Text-fig. 415). Distinguished by the form of the two stout, coarsely scobinate processes arising from the apex of the dorsal margin of the valve.

It is a pleasure to name this species in honour of Mrs Anna Forbes-Watson, whose Lepidoptera from Nimba in Liberia have been collected and prepared with such great care.

DISTRIBUTION. Liberia.

Holotype ♂, LIBERIA: Nimba, Grassfield, vi-vii. 1967 (*A. Forbes-Watson*), Geometridae genitalia slide no. 7828, in BMNH.

### THE *CRYSTALLOPHANA*-GROUP

Externally similar in colour and pattern to species in the *reflexaria*- and *triangularis*-groups. Characterized in the male genitalia by the short, broad uncus with its semi-circular, setose, lateral projections, one at each side, and by the form of the valve, which is broadly rounded at apex and has a strongly developed, spined ridge parallel with the apical half of the ventral margin. Characterized in the female genitalia by the elaborately developed sterigma (Pl. 87, figs 805, 806).

Only one species is included in the group.

### *Zamarada crystallophana* Mabille

(Text-figs 416, 417; Pl. 87, figs 802, 805, 806; Pl. 121, figs 1086-1088)

*Zamarada crystallophana* Mabille, 1900 : 741. Holotype ♀, 'W. AFRICA' (BMNH) [examined.]

♂ ♀ (Pl. 121, figs 1086-1088). Closely similar in size, colour and pattern to species in the *reflexaria*-group, *cucharita* and *r. reflexaria*. West African populations of *crystallophana* may usually be distinguished by the narrower excavation of the non-hyaline terminal area of the wings between veins  $M_3$  and  $Cu_{1b}$  and the rather larger discal spot on the fore wing (Pl. 121, fig. 1086).

The male hind tibia is dilate with a pocket one-half as long as the tibia enclosing a tuft of hair-scales little longer than the width of the tibia.

♂ genitalia (Text-figs 416, 417). Apical half of uncus short and digitate, apex rounded; a dorsally setose, semi-circular projection from each side of base. Ventral plate of gnathus strongly sclerotized, rounded at apex. Juxta Y-shaped. Valve with a strongly developed, spined ridge parallel with the apical half of the ventral margin; a second, shorter ridge near broadly rounded apex, the shorter ridges sometimes asymmetrical; dorsal process with a slender, club-shaped, setose projection from near base. Aedeagus with scobinate ridge at four-fifths, varying developed. Fulcrum rounded at apex, which is smooth.

♀ genitalia (Pl. 87, figs 802, 805, 806). Posterior margin of elaborately developed lamella postvaginalis asymmetrical; the posteriorly inclined, scobinate, tapered projections, one from each side, are longer in the Malawi and Mozambique specimens (Pl. 87, fig. 806). Abdomen with two small, lateral pockets, one at each side, in membrane between segments six and seven.

Measurements. Fore wing: ♂ 15.0-18.5 mm; ♀ 15-17 mm. Antennal pectinations: ♂ 7 ×, ♀ 3 × diameter of shaft.

Structurally the male of *crystallophana* may be distinguished from *cucharita* and *reflexaria* by the appreciably shorter tuft of hair-scales on the hind tibia and by the form of the uncus, valve and fulcrum in the genitalia; in the female genitalia the form of the sterigma is diagnostic.

In a short series from Elisabethville and from Zambia the excavation of the non-hyaline terminal area between veins  $M_3$  and  $Cu_{1b}$  is broad and smooth, as in *reflexaria aphis* (Pl. 121, fig. 1087). The series from Mozambique is shorter-winged (♂ ♀ 15-16 mm) and has a smaller discal spot on the fore wing (Pl. 121,



fig. 1088). There does not appear to be any correlation between these variations in wing pattern and the minor modifications noted in the symmetry of the valves.

DISTRIBUTION. Equatorial Africa.

#### MATERIAL EXAMINED.

*Zamarada crystallophana* Mabille, holotype ♀, 'W. AFRICA', without abdomen, in BMNH.

SENEGAL: Sedhiou, vii. 1917 (*H. Castell*), 2 ♂. IVORY COAST: Bingerville, iii, v, ix (*G. Melou*), 2 ♂, 1 ♀ (BMNH); Lamto, 36 km N.N.W. of Tiassalé, 20-23.iv.1969 (*C. Herbulot*), 1 ♂ (coll. Herbulot, Paris). GHANA: Tarkwa (*A. F. Brazenor*), 1 ♀; Kumasi, Friapere Forest, 1 ♀. NIGERIA: R. Niger, Sapele (*F. W. Sampson*), 1 ♂. CAMEROUN: Yoko (Joko) (*Colin*), 1 ♂ (MNHU, Berlin); 6 km N.E. d'Edea, 28-29.iii.1970, 1 ♂; 8 km N. d'Edea, 30.iii-1.iv.1970, 2 ♂, 2 ♀ (all *C. Herbulot*); Savanes d'Akak, 14 km N.N.E. Yaoundé, 28.viii.1971, 1 ♂; M'Balmayo, Ecole forestière, 11.ix.1971, 1 ♂ (both *P. Darge*) (all coll. Herbulot, Paris); Efulen, ii-iv, vi, xi (*H. L. Weber*), 8 ♂, 2 ♀ (CM, Pittsburgh); Epulan, iv. 1926 (*G. Schwab*), 3 ♂, 1 ♀ (BMNH). ZAIRE ('Belgian Congo'): Equateur, Loile River, Ikela, iv. 1959 (*R. H. Carcasson*), 1 ♂; Eastern Upper Ituri Valley, 30 miles S. of Irumu, tropical forest, 3000 ft, vii. 1924 (*T. A. Barns*), 1 ♂; Elisabethville, i, iv-v (*C. Seydel*), 5 ♂ (all BMNH). ZAMBIA: Mwinilunga, Ksombo-Sombo, iv. 1963, 1 ♂ (NMR, Bulawayo); Zambezi, Mwinilunga, v. 1963, 1 ♂ (BMNH). UGANDA: Entebbe, iv. 1961, 1 ♂ (NMR, Bulawayo); ibidem, iii. 1961 (*N. Mitton*), 1 ♀ (BMNH); ibidem, xi. 1962 (*E. S. Brown*), 1 ♂ (NMK, Nairobi). KENYA: Kenya Coast, Shimba Hills, xii. 1961 (*R. H. Carcasson*), 1 ♂, 1 ♀ (NMK, Nairobi). TANZANIA: Amani, ii. 1953 (*E. Pinhey*), 1 ♂ (BMNH); ibidem, xi. 1965, 1 ♂; Kigoma, Mukuyu, xii. 1963, 1 ♂ (both NMK, Nairobi). MOZAMBIQUE: Beira, Savanie Forest, x, xi, 3 ♂; Chiluvo Hills, Vila Machado, 30.x.1967, 3 ♂; Chiluvo Hills, x-xi. 1963, 6 ♂ (all NMR, Bulawayo); Xiluvo, Vila Machado dist., 15.i.1964 (*D. M. Cookson*), 1 ♂ (TM, Pretoria); Dondo Forest, x-xi, 2 ♂ (NMR, Bulawayo). MALAWI: Mt Mlanje, ii, iv (*S. A. Neave*), 1 ♂, 1 ♀ (BMNH); Nkata Bay, xii. 1964, 1 ♀; Nkata Bay, Mkuwadzi Forest, v. 1966, 2 ♂ (all NMR, Bulawayo). RHODESIA: Vumba, 22.iii.1966 (*B. D. Barnes*), 1 ♂ (NMR, Bulawayo).

#### THE *LATIMARGO*-GROUP

Moths in the group have the hyaline area of the wings tinged with green or yellow and densely and coarsely striate with grey; discal spot on fore wing large and ovate, grey outlined with dark brown, that on hind wing slender. Non-hyaline terminal area greyish brown, the subterminal fascia marked in a darker shade.

Characterized in the male genitalia by the tapered, simple valve and the very short, setose projection from its dorsal process, by the finely tapered aedeagus, scobinate in apical fourth, with or without a digitate projection at one-half, and

by the hooded, coarsely toothed apical fourth of the strongly sclerotized core of the fulcrum.

In the female genitalia the sterigma is very weakly developed and there is a scobinate, transverse band across the posterior eighth of the corpus bursae.

The male hind leg is elaborately scaled; inner surface of femur densely clad with short, very broad, light buff scales and tufted with very long hair-scales near tibial joint; tibia grossly dilate enclosing a dense tuft of hair-scales, the tuft just subequal in length to that of tibia; outer surface of tibia tufted with very long hair-scales near joint with femur.

#### KEY TO SPECIES

- 1 Medial area of valve concave and scoop-like, apical area minutely scobinate and incurved towards uncus. Aedeagus with digitate projection at one-half, the smoothly rounded apex of which extends to four-fifths . . . . . 2
- Valve not so formed; apical area smooth and tapered to a point. Aedeagus without digitate projection . . . . . *leona* (p. 249)
- 2 (1) Non-hyaline terminal area light grey, narrow and only shallowly excavate on each wing between veins  $M_3$  and  $Cu_{1b}$  (Pl. 122, figs 1089, 1090). Coarsely serrate apical fourth of fulcrum dilate . . . . . *janata* (p. 248)
- Non-hyaline terminal area greyish brown, deeply excavate on each wing between veins  $M_3$  and  $Cu_{1b}$  (Pl. 122, fig. 1091). Fulcrum of even width from base to apex . . . . . *latimargo* (p. 247)

### *Zamarada latimargo* Warren

(Text-figs 418, 419; Pl. 86, figs 798, 799; Pl. 122, fig. 1091)

*Zamarada latimargo* Warren, 1897 : 261. Holotype ♂, ZAIRE (BMNH) [examined].

*Zamarada funebris* Gaede, 1915 : 122, pl. 2, fig. 18. Holotype ♂, CAMEROUN (MNHU, Berlin) [examined]. **Syn. n.**

♂♀ (Pl. 122, fig. 1091). Hyaline area of wings coarsely striate with grey, vinaceous tinged in oblique light, and finely edged distally with brown; discal spot greyish brown irrorate with brown, large on fore wing, very slender on hind wing. Non-hyaline terminal area of each wing uniformly greyish brown (pl. 5, D3); dentate subterminal fascia brown, finely edged distally with glossy buff. Underside of non-hyaline terminal area uniformly greyish brown.

The male hind femur is fringed with long buff hair-scales; the hind tibia is dark grey, tufted with long dark grey hair-scales at its joint with the femur.

♂ genitalia (Text-figs 418, 419). Uncus short, apex narrowly rounded. Ventral plate of gnathus slender and minutely scobinate, the apex rounded. Juxta bifurcate. Medial area of valve concave and scoop-like, apical area incurved towards uncus through 90 degrees and tapered to narrowly rounded tip; dorsal process with small, triangular, setose projection near base. Aedeagus finely tapered, apical fourth coarsely scobinate on dorsal surface; ventral surface with a digitate projection at one-half. Fulcrum shorter than aedeagus, of even width from base to apex and coarsely serrate along apical fourth of dorsal surface.

♀ genitalia (Pl. 86, figs 798, 799). Lamella antevaginalis sclerotized in semi-circular form; lamella postvaginalis consisting of weakly sclerotized, concentric, semi-circular ridges. Short transverse, minutely scobinate ridge across posterior margin of corpus bursae.

Measurements. Fore wing: ♂ 15-17 mm; ♀ 15.5-16.5 mm. Antennal pectinations: ♂ 6 ×, ♀ 4 × diameter of shaft.

Similar in colour and pattern to *variola*, which follows later in the genus in the *eucharis*-group. Distinguished externally by its shorter wing and by the smooth-edged excavation of the non-hyaline terminal area between veins  $M_3$  and  $Cu_{1b}$  and further in the male by the fringed hind femur and the dark grey, tufted and grossly dilate hind tibia.

In the male genitalia the form of the fulcrum and in the female genitalia the form of the lamella antevaginalis are diagnostic.

DISTRIBUTION. Nigeria, Cameroun, Central African Republic, Zaire, Uganda.

#### MATERIAL EXAMINED.

*Zamarada latimargo* Warren, holotype ♂, ZAIRE ('Belgian Congo'): Upper Congo (Oram), Geometridae genitalia slide no. 1639, in BMNH. *Zamarada funebris* Gaede, holotype ♂, CAMEROUN ('S. Kamerun'): Ngoko Stat., 7.v.1902 (Hösemann), in MNHU, Berlin.

NIGERIA: Warri, iv, vi. 1897 (Dr Roth), 2 ♂. CAMEROUN: Savanes d'Akak, 14 km N.N.E. of Yaoundé, 28.viii.1971 (P. Darge), 1 ♂ (coll. Herbulot, Paris); Yaoundé, 12.viii.1897 (G. Zenker), 1 ♀; Doumé (Düme), 18.v.1902 (Freyer), 1 ♀ (both MNHU, Berlin); Batouri District, iii-iv. 1935 (F. G. Merfeld), 1 ♂ (BMNH); M'Balmayo, Ecole forestière, 11.ix.1971 (P. Darge), 1 ♂ (coll. Herbulot, Paris); Lolodorf, 1894-1895 (L. Conradt), 1 ♂ (BMNH); Efulen, vi. 1922 (H. L. Weber), 2 ♂ (CM, Pittsburgh). CENTRAL AFRICAN REPUBLIC: Bimbo, 24.iv.1970 (C. Lemaire), 1 ♂ (coll. Herbulot, Paris). ZAIRE ('Belgian Congo'): Congo River above Nouvelle Anvers, v. 1920 (T. A. Barns), 1 ♀ (BMNH); Ituri, Bunia, Mt Hoyo, iii. 1959 (R. H. Carcasson), 1 ♂ (NMK, Nairobi). UGANDA: Bwamba, v. 1958 (R. H. Carcasson), 1 ♂ (NMK, Nairobi).

#### *Zamarada janata* sp. n.

(Text-fig. 420; Pl. 86, figs 800, 801; Pl. 122, figs 1089, 1090)

♂ ♀ (Pl. 122, figs 1089, 1090). Hyaline area of wings yellowish grey varyingly striate with grey, the grey striae vinaceous tinged in oblique light, and finely edged distally with brown; discal spot on fore wing brownish grey outlined with brown; discocellulars on hind wing very slenderly brown. Non-hyaline terminal area narrow, brownish grey (pl. 5, C2), varyingly irrorate with brown and whitish grey and smoothly and shallowly excavate between veins  $M_3$  and  $Cu_{1b}$ ; weakly marked, dentate subterminal fascia present only in anterior and posterior areas of each wing, because of the narrow width of the non-hyaline terminal area.

The long tufts of hair-scales on the male hind leg are light buff at base, darkening apicad; the grossly dilate hind tibia is buff varyingly irrorate with grey.

♂ genitalia (Text-fig. 420). Differ from those of *latimargo* in the shorter fulcrum, the serrate apical fourth being dilate.

♀ genitalia (Pl. 86, figs 800, 801). Differ from those of *latimargo* in the slightly asymmetrical sclerotization of the lamella antevaginalis, the right side being better developed.

Measurements. Fore wing: ♂ 17-19 mm; ♀ 17-18 mm. Antennal pectinations: ♂ 6 ×, ♀ 4 × diameter of shaft.

Externally distinct in the pale grey colour of the narrow, non-hyaline terminal area.

The species varies markedly in the amount of grey striation in the hyaline area; examples from Elisabethville and from Kolwezi range from the coarsely striate to the immaculate; the genitalia of both sexes of these extreme forms appear to be identical.

DISTRIBUTION. E. Zaire, Zambia.

Holotype ♂, ZAIRE ('Belgian Congo'): Elisabethville, 10.iii.1950 (C. Seydel), in MRAC, Tervuren.

Paratypes. ZAIRE ('Belgian Congo'): Elisabethville, 3.xi.1948 (C. Seydel), 1 ♂; ibidem, 9.xi.1948, 1 ♀; 5.xii.1950, 1 ♀; 30.xii.1948, 1 ♀ (all MRAC, Tervuren); ibidem, i, v, ix-xii, 11 ♂ (all BMNH); Katanga, Kolwezi, viii. 1966, 1 ♀ (BMNH); ibidem, ix, xi (V. Allard), 2 ♂ (NMK, Nairobi); Ht Katanga, Shinkolobwe, 16.x.1931, 1 ♂ (BMNH); ibidem, 21.vii.1931 (J. Romieux), 1 ♂ (MHN, Geneva). ZAMBIA: Ndola, iii. 1960, 1 ♂ (NMR, Bulawayo); Zambezi Rapids, Mwinilunga, 1.v.1963, 1 ♀ (BMNH); Mwinilunga, v. 1961, 1 ♀ (NMR, Bulawayo); Lisombo River, Mwinilunga, 29.iv.1963, 1 ♂ (BMNH).

### *Zamarada leona* Gaede

(Text-figs 421, 422; Pl. 87, figs 803, 804; Pl. 122, fig. 1092)

*Zamarada leona* Gaede, 1915 : 122, pl. 2, fig. 19. Holotype ♂, SIERRA LEONE (MNHU, Berlin) [examined].

♂ ♀ (Pl. 122, fig. 1092). Hyaline area of wings greenish yellow varyingly, but coarsely striate with grey, vinaceous tinged in oblique light, and finely edged distally with greyish brown; discal spot on fore wing grey outlined with greyish brown, that on hind wing greyish brown and minute. Non-hyaline terminal area greyish brown (pl. 6, D3) irrate with a darker shade; dentate subterminal fascia a dark shade of greyish brown (pl. 6, F3, negro), finely edged distally with glossy buff. Underside of non-hyaline terminal area uniformly greyish brown.

The male hind leg is similar in colour to that of *latimargo*.

♂ genitalia (Text-figs 421, 422). Uncus tapered to a point. Ventral plate of gnathus minutely scobinate, rounded at apex. Juxta bifurcate, weakly sclerotized. Apical area of valve smoothly sclerotized, tip sharply pointed. Apex of aedeagus finely tapered, minutely scobinate on dorsal surface. Fulcrum with broad, hammer-headed apex, dorsal surface scobinate.

♀ genitalia (Pl. 87, figs 803, 804). Sterigma asymmetrical. Lamella antevaginalis rectangular, lateral and anterior margins regularly and minutely serrate, posterior margin irregular; right side more extensively folded than the left. Lamella postvaginalis crenulate and folded. Corpus bursae weakly sclerotized posteriorly with short, serrate ridge at left side.

Measurements. Fore wing: ♂ 15-17 mm; ♀ 15-16 mm. Antennal pectinations: ♂ 7 ×, ♀ 5 × diameter of shaft.

Distinguished externally from similarly patterned species in the *reflexaria*, *triangularis* and *crystallophana*-groups by the presence of coarse grey striation in the hyaline area of each wing and by the reduction, or more usually the absence of buff from the non-hyaline terminal area of the hind wing; the male is further



distinguished by the specialization of the hind leg. Distinguished from *latimargo* and *janata* by the darker, greyish brown non-hyaline terminal area with its well marked subterminal fascia. In the male genitalia the form of the tapered valve and uncus and of the hammer-headed apex of the fulcrum and in the female genitalia the form of the sterigma are diagnostic.

DISTRIBUTION. Sierra Leone, Liberia, Ivory Coast, Ghana.

#### MATERIAL EXAMINED.

*Zamarada leona* Gaede, holotype ♂, SIERRA LEONE: 1887-88, coll. Staudinger, in MNHU, Berlin.

SIERRA LEONE: Freetown, x-xii. 1968 (*D. F. Owen*), 5 ♂, 2 ♀; Freetown, Mt Aureol, xii. 1955 (*J. Phipps*), 1 ♀; Hill Station, near Freetown, 800 ft, vi-vii. 1921 (*W. R. Thompson*), 1 ♂; Hill Station, xi. 1933 (*M. Frere*), 3 ♂; Bishop's Court (*F. C. Smith*), 1 ♂; Moyamba, v. 1903 (*D. Cator*), 2 ♀; Bambawo, 13.vi.1969 (*R. J. Revell*), 1 ♂; Bo, x. 1968 (*R. J. Revell*), 1 ♂; Batkanu, 80 miles inland from Freetown (*Fitzgerald*), 1 ♀ (all BMNH); Kennema, Railway District, c. 200 ft, v-xii. 1911 (*Mrs M. Addison*), 2 ♂, 1 ♀ (UM, Oxford). LIBERIA: Marshall Terr., Harbel, 26.xii.1956 (*R. M. Fox*), 1 ♂ (CM, Pittsburgh). IVORY COAST: Bingerville, 13.iii.1915 (*G. Melou*), 1 ♂; ibidem, v-vi. 1915, 14 ♂, 4 ♀; ibidem, vii-xi, 6 ♂, 2 ♀ (all BMNH); Yapo-Sud, 22 km S.S.E. of Agboville, 12-18.iv.1969 (*C. Herbulot*), 8 ♂, 5 ♀; Lamto, 36 km N.N.W. of Tiassalé, 20-23.iv.1969 (*C. Herbulot*), 1 ♂, 1 ♀ (all coll. Herbulot, Paris). GHANA: Kumasi (*H. Whiteside*), 1 ♂, 2 ♀; Sekondi (*N. T. Hamlyn*), 2 ♀; 20 miles W. & N.W. of Sekondi (*L. R. Tesch*), 1 ♂; A'Koon, 25.vi.1919 (*G. Harrison*), 1 ♀.

#### THE *EMACIATA*-GROUP

Externally similar in colour and pattern to *crystallophana*, to *leona* in the *latimargo*-group and to species in the *tullia*, *paxilla*, *tortura* and *eucharis*-groups which follow.

Characterized in the male genitalia by the form of the uncus, with its broadly rounded apex, the deep ventral plate of the gnathus, the form of the asymmetrical valves and the finely tapered aedeagus and by the vestigial fulcrum.

#### *Zamarada emaciata* sp. n.

(Text-figs 423, 424; Pl. 88, figs 808, 809; Pl. 121, fig. 1085)

♂ genitalia (Text-figs 423, 424). Apex of uncus broadly rounded, basal half produced laterally. Ventral plate of gnathus broadly rounded at apex, sclerotized area extending anteriorly. Valves asymmetrical; left valve coarsely scobinate and spine-tipped at apex; right valve smoothly rounded at apex and dorsally setose; dorsal process with long, digitate, setose projection from near base. Aedeagus finely tapered and minutely serrate medially on ventral surface. Fulcrum slender, vestigial. Coremata greyish buff.

♀ genitalia (Pl. 88, figs 808, 809). Posterior margin of lamella antevaginalis deeply excised medially; distal margin of each lateral projection minutely serrate. Lamella postvaginalis consisting of a slender, sclerotized, arcuate transverse band, broadened medially and finely tapered laterally.

Measurements. Fore wing: ♂ 16–18 mm; ♀ 15–16 mm. Antennal pectinations: ♂  $6 \times$  ♀  $2 \times$  diameter of shaft.

Externally closely similar in size, colour and pattern to *crystallophana* and to *leona* in the *latimargo*-group. Distinguished from *leona* by the appreciably finer and sparser grey striation of the hyaline area and the shallower excavation of the non-hyaline terminal area of each wing between veins  $M_3$  and  $Cu_{1b}$ , and by the absence of a discal spot on the hind wing (Pl. 121, fig. 1085). The male may be further distinguished by the simpler hind tibia, which is dilate with a pocket extending along one-half of its length, but without a conspicuous tuft of hair-scales; the female may be further distinguished by the shorter antennal pectinations, which are twice instead of five times as long as the diameter of the shaft. Reliably distinguished from *crystallophana* only by the genitalia.

Similar also to *tullia*, which follows, but distinguished by the blacker grey non-hyaline terminal area and the more strongly marked subterminal fascia and in the male by the conspicuously bright buff coremata.

In the male genitalia the form of the asymmetrical valves and in the female the form of the sterigma are diagnostic.

DISTRIBUTION. Senegal, Guinea, Ivory Coast, Cameroun, Gabon.

Holotype ♂, CAMEROUN ('Kamerun'): Lolodorf, 1894–1895 (L. Conradt), Geometridae genitalia slide no. 7602, in BMNH.

Paratypes. SENEGAL: Sedhiou, 1917 (H. Castell), 1 ♂; ibidem, 5–12.vii.1917, 1 ♂; 20–30.viii.1917, 1 ♂, 1 ♀ (all BMNH). GUINEA: Forekariah (Dr Mir. Mrázek), 1 ♂ (MM, Brno). IVORY COAST: Abidjan, 1 ♂ (NMK, Nairobi). CAMEROUN: Ndongue, 10 km S.S.W. of N'Kongsamba, 650 m, 17.x.1971 (P. Darge), 1 ♂ (coll. Herbulot, Paris); Johann-Albrechts Höhe (Conradt), 1 ♂, 2 ♀ (BMNH), 1 ♀ (MNHU, Berlin); Efulen, 15.iii.1923 (H. L. Weber), 1 ♀; ibidem, v–vii, x, 5 ♂ (all CM, Pittsburgh); M'Balmayo, Ecole forestière, 7.x.1971 (P. Darge), 2 ♂. GABON: Mouila, ix–x. 1964 (P. Darge), 3 ♂ (all coll. Herbulot, Paris).

#### THE *TULLIA*-GROUP

Externally closely similar in colour and pattern to the *emaciata*-group.

Characterized in the male genitalia by the form of the symmetrical valves, minutely and densely scobinate in the apical area with a short, scobinate ridge almost parallel with and close to each ventral margin at three-fourths to four-fifths and by the weakly developed or vestigial fulcrum. The uncus is short and blunt, the ventral plate of the gnathus well developed and scobinate, the aedeagus finely tapered, with or without projection.

## KEY TO SPECIES

- 1 Apex of valve incurved towards uncus and finely tapered; dorsal process with broad, setose projection near base. Fulcrum one-half as long as aedeagus, apex scobinate . . . . . *sagitta* (p. 253)  
 - Apex of ventral margin of valve produced in slender, digitate form, not incurved towards uncus; dorsal process without setose basal projection. Fulcrum vestigial. . . . . *tullia* (p. 253)

*Zamarada tullia* Oberthür

(Text-figs 425, 426; Pl. 89, figs 812, 813; Pl. 122, fig. 1093)

*Zamarada thalia* Oberthür, 1912 : 260, 351, pl. 153, fig. 1470 nec fig. 1471; nec 1912 : 258, pl. 152, fig. 1459. LECTOTYPE ♂, CAMEROUN (BMNH), here designated [examined]. [Primary homonym of *Zamarada thalia* Oberthür, 1912 : 258.]

*Zamarada tullia* Oberthür, 1913 : 237. [Replacement name for *Zamarada thalia* Oberthür, 1912 : 260.]

*Zamarada tullia* Strand, 1915 : 178. [Replacement name for *Zamarada thalia* Oberthür, 1912 : 260. Primary homonym of *Zamarada tullia* Oberthür, 1913 : 237.]

*Zamarada thalysia* Gaede, 1915 : 116. [Replacement name for *Zamarada thalia* Oberthür, 1912 : 260.]

♂ genitalia (Text-figs 425, 426). Uncus tapered to blunt apex; base with a pair of slight, lateral processes. Ventral plate of gnathus broadly rounded apicad and scobinate. Juxta weakly sclerotized, with two longitudinal, parallel ridges. Valves symmetrical, apices minutely scobinate; ventral margin produced in slender, digitate form; dorsal process without setose projection near base. Aedeagus and fulcrum similar to those of *emaciata*. Coremata bright buff.

♀ genitalia (Pl. 89, figs 812, 813). Lamella antevaginalis slender and weakly sclerotized, anterior margin narrowly incised medially. Lamella postvaginalis consisting of a broad transverse band convexly curved, posterior margin minutely but densely scobinate. Posterior tip of corpus bursae sclerotized with transverse, medial ridge.

Measurements. Fore wing: ♂ 16.5–17.5 mm; ♀ 16.5 mm. Antennal pectinations: ♂ 6 ×, ♀ 3 × diameter of shaft.

Externally closely similar to *emaciata*; distinguished by the denser, finer grey striation of the hyaline area concentrated in the posterior half of each wing, by the presence of a minute discal spot on the hind wing and by the duller, matt-grey of the non-hyaline terminal area (Pl. 122, fig. 1093). The male may be further distinguished from *emaciata* by the bright buff colour of the coremata.

In the male genitalia the form of the valves and in the female genitalia the form of the lamella postvaginalis are diagnostic.

DISTRIBUTION. Cameroun, Gabon.

## MATERIAL EXAMINED.

*Zamarada thalia* Oberthür, lectotype ♂ here designated, CAMEROUN ('Kamerun'): Lolodorf, 1894–1895 (*L. Conradt*): '*Zamarada thalia* ♂ Obthr. figurer la patte pour montrer les 2 épines de l'article median: *Tullia* Obthr., *Thalia* ex error' [both labels in Oberthür's hand-writing]; black and white copy of fig. 1470: Geometridae genitalia slide no. 5616, in BMNH.

*Zamarada thalia* Oberthür is a primary homonym of the name of a species now included in the *excavata*-group. Oberthür recognized his error and published *tullia* as a replacement name. Unnecessary replacement names were subsequently published by both Strand and Gaede, the former proposing *tullia*, the latter *thalysia*.

The species was based on a mixed series. The paralectotype, figured by Oberthür (1912: pl. 153, fig. 1471) represents a species that is described under the name *mimesis* sp. n. in the *eucharis*-group.

CAMEROUN: Savanes d'Akak, 14 km N.N.E. of Yaoundé, 28.viii.1971, 1 ♀; M'Balmayo, Ecole forestière, ix-x. 1971, 2 ♂ (all *P. Darge*); Nkoemvom près Ebolowa, 18.iv.1970 (*C. Lemaire*), 2 ♂ (all coll. Herbulot, Paris); Efulen, i, iv, vi, x-xi (*H. L. Weber*), 5 ♂, 2 ♀ (CM, Pittsburgh). GABON: Belinga, Camp Central, 700 m, 11.iii.1963 (*G. Bernardi*), 1 ♂ (MBG, Paris); Mouila, ix-x, 1964 (*P. Darge*), 3 ♂, 5 ♀ (coll. Herbulot, Paris).

### *Zamarada sagitta* sp. n.

(Text-figs 427, 428; Pl. 89, figs 814, 815; Pl. 123, fig. 1101)

♂ genitalia (Text-figs 427, 428). Uncus broadly rounded at apex, dorsal surface densely setose. Ventral plate and arms of gnathus strongly sclerotized, the plate coarsely scobinate. Valves symmetrical; apical fifth scobinate, incurved towards uncus and finely tapered; a short scobinate ridge at three-fourths ventral margin; dorsal process with setose projection near base. Aedeagus with short, smoothly rounded projection at two-thirds. Fulcrum slender and weakly developed, apex scobinate.

♀ genitalia (Pl. 89, figs 814, 815). Lamella postvaginalis arrow-headed in form, posteriorly inclined medial point strongly sclerotized, tapering lateral margins scobinate.

Measurements. Fore wing: ♂ 13-14 mm; ♀ 11-13 mm. Antennal pectinations: ♂ 11 ×, ♀ 4 × diameter of shaft.

Externally closely similar to *emaciata* in colour and pattern; distinguished from it and from the many similarly patterned species in the groups following the *reflexaria*-group by its shorter wing length (Pl. 123, fig. 1101). The males are further distinguished from *tullia* by the sparse, light buff coremata and by the longer antennal pectinations. The male hind tibia is not dilate, but there is a short, sclerotized pocket, little longer than the width of the tibia, near the femoral joint.

In the male genitalia the form of the valve, aedeagus and fulcrum and in the female the form of the lamella postvaginalis are diagnostic.

DISTRIBUTION. Nigeria, Cameroun, Gabon.

Holotype ♂, CAMEROUN ('Kamerun'): Efulen, 17.vi.1922 (*H. L. Weber*), in CM, Pittsburgh.

Paratypes. NIGERIA: Ikom, iii. 1930 (*E. Haig*), 1 ♂; ibidem, 7.v.1930, 1 ♀; Ikom, ii. 1957 (*J. Boorman*), 2 ♂, 1 ♀ (all BMNH). CAMEROUN: N'Kongsamba, iii. 1958 (*P. Darge*), 2 ♂; ibidem, iv. 1958, 1 ♂, 2 ♀; v. 1958, 6 ♂, 3 ♀; vi. 1958, 1 ♀; vii. 1958, 3 ♂, 1 ♀ (all coll. Herbulot, Paris); Johann-Albrechts Höhe,



i.vi.1896 (*L. Conradt*), 1 ♂ (MNHU, Berlin); ibidem, 1898, 1 ♀ (BMNH); 6 km N.E. d'Edea, 28-29.iii.1970, 1 ♂; 8 km N. d'Edea, 30.iii-1.iv.1970, 2 ♂ (all *C. Herbulot*, in coll. Herbulot, Paris); Efulen, 11-24.iii.1923 (*H. L. Weber*), 4 ♂, 1 ♀; ibidem, 10-25.iv.1923, 1 ♂, 2 ♀; v, 6 ♂, 1 ♀; 6-21.vi.1922, 4 ♂, 5 ♀; vii, 1 ♂, 3 ♀; 30.ix.1921, 1 ♂; 7.x.1912, 1 ♀; 21.x.1922, 1 ♂, 2 ♀; 24-25.x.1924, 3 ♀; 18.xi.1922, 1 ♂; 11-30.xii, 6 ♂ (all CM, Pittsburgh); Epulan, 6.iv-1.v.1926 (*G. Schwab*), 8 ♂, 3 ♀ (BMNH). GABON: Mouila, 7-10.x.1964 (*P. Darge*), 1 ♂, 1 ♀ (coll. Herbulot, Paris).

### THE *PAXILLA*-GROUP

Externally almost identical with *tullia*; males may be distinguished by the very light buff coremata and by the fringe of long, light buff hair-scales on the hind femur.

Characterized in the male genitalia by the form of the symmetrical valves, each with an apical, inwardly-pointing, peg-like projection and by the form of the bifurcate fulcrum, each of the twin blade-like halves being serrate-edged along the ventral margin.

### *Zamarada paxilla* sp. n.

(Text-figs 429, 430; Pl. 88, figs 807, 810, 811; Pl. 122, fig. 1094)

♂ genitalia (Text-figs 429, 430). Uncus short, curved ventrad and tapered. Ventral plate of gnathus slenderly digitate, strongly sclerotized and scobinate. Valves symmetrical, each apex with an inwardly pointing, peg-like projection; dorsal process with a long, densely setose, digitate projection near base. Aedeagus tapered. Fulcrum bifurcate, each of twin, blade-like halves serrate-edged on ventral margin. Coremata very light buff.

♀ genitalia (Pl. 88, figs 807, 810, 811). Sterigma strongly sclerotized and tapered posteriorly. Posterior margin of lamella antevaginalis bilobate. Lamella postvaginalis with ovate, ventral projection near posterior margin.

Measurements. Fore wing: ♂ 15-18 mm; ♀ 15-17 mm. Antennal pectinations: ♂ 8 ×, ♀ 4 × diameter of shaft.

Almost identical in colour and pattern (Pl. 122, fig. 1094) with *tullia* and with the following species, *tortura* sp. n.; males may be distinguished by the very light buff coloured coremata and by the fringe of light buff hair-scales on the hind femur. In the male genitalia the form of the valve and of the fulcrum and in the female the form of the very strongly sclerotized sterigma are diagnostic.

DISTRIBUTION. W. Africa, Guinea to Angola, Zaire, Uganda.

Holotype ♂, IVORY COAST: Bingerville, 11.vi.1915 (*G. Melou*), Geometridae genitalia slide no. 7820, in BMNH.

Paratypes. GUINEA: Massadou, near Macenta, 1600 ft, 13-17.v.1926, 1 ♂; Boukouni, near Macenta, 1750 ft, 11.v.1926, 1 ♂; Macenta, 2000 ft, v. 1926, 1 ♂, 1 ♀ (all *C. L. Collenette*, in BMNH); Beyla (*Dr Mir. Mrázek*), 1 ♂ (MM, Brno). LIBERIA: Marshall Territory, Harbel, 7-8.xi.1955 (*R. M. Fox*), 1 ♂, 1 ♀ (CM, Pittsburgh). IVORY COAST: Bingerville, 1915 (*G. Melou*), 2 ♂; ibidem, v-viii,

xi, 6 ♂, 6 ♀ (all BMNH); Yapo-Sud, 22 km S.S.E. of Agboville, 12-18.iv.1969 (*C. Herbulot*), 3 ♂, 1 ♀ (coll. Herbulot, Paris). GHANA: Ashanti, Juaso, 8.ix.1937 (*G. S. Cansdale*), 1 ♀; Kumasi (*H. Whiteside*), 1 ♂; Bibiani (Bibianaha), 70 miles N.W. of Dunkwa (Dimkwa), 700 ft, 1.x.1910 (*H. G. F. Spurrell*), 1 ♂; Aburi (*W. H. Patterson*), 1 ♀. NIGERIA: Ilesha (*Humfrey*), 2 ♂ (BMNH); Lagos, viii. 1910 (*J. A. de Gaye*), 1 ♂ (UM, Oxford); Lagos, 1 ♀ (BMNH); 70 miles E. of Lagos, E. shore of Lekki Lagoon, forest and native clearings (*W. A. Lamborn*), 1 ♀ (UM, Oxford); Warri, 4.vii.1896 (*Dr Roth*), 1 ♀; Old Calabar (*White*), 2 ♂ (BMNH); Old Calabar, 150 ft, i-ii. 1902 (*C. J. M. Gordon*), 1 ♂ (UM, Oxford). CAMEROUN: Johann-Albrechts Höhe, 1896 (*L. Conradt*), 1 ♂ (BMNH); Yaoundé, 1.ii.1970 (*P. Darge*), 1 ♂ (coll. Herbulot, Paris); Lolodorf (*L. Conradt*), 1 ♂ (BMNH); Efulen, 31.v.1922 (*H. L. Weber*), 1 ♂; ibidem, xi. 1922, 1 ♂ (both CM, Pittsburgh); Bitje, Ja River, iv-vi, 7 ♂ (BMNH). GABON: Belinga, Camp Central, 700 m, 14.iii.1963 (*G. Bernardi*), 1 ♂ (MBG, Paris); Abanga, 24.xi.1968, 1 ♀; Mouila, 3.x.1964, 1 ♀; Franceville, 15.xi.1963, 1 ♂ (all *P. Darge*, in coll. Herbulot, Paris). ANGOLA: Prov. Nordcuanza, Canzele, 30 km nördl. Quiculungo, 18-22.x.1957 (*Gerd Heinrich*), 2 ♂, 2 ♀ (ZSBS, Munich). ZAIRE ('Belgian Congo'): Upper Uele District, v, 2 ♂ (BMNH); Yaleko, iii. 1959, 1 ♂; Opala, Lomami River, iii. 1959, 1 ♂, 1 ♀ (all *R. H. Carcasson*, in NMK, Nairobi); Luluabourg, 6.ix.1957 (*C. Seydel*), 1 ♂ (BMNH); Elisabethville, 10.xi.1946 (*C. Seydel*), 1 ♂ (ZSBS, Munich); W. Kivu, South Lowa District, Lowowo Valley, 4000 ft, mountain forest, iii. 1924, wet season, 1 ♂; Middle Lowa Valley, near Walikali, 3-4000 ft, forest, ii. 1924, 2 ♂; Upper Lowa Valley, near Masisi, 5-6000 ft, forest and long grass, ii. 1924, 1 ♂; Lindi Valley, Kondolola District, 1600-1700 ft, v. 1921, 1 ♂ (all *T. A. Barns*, in BMNH). UGANDA: Bwamba, ix. 1961 (*N. Mitton*), 1 ♂; Ankole, Kalinzu Forest, iv. 1965 (*J. Scheven*), 1 ♀ (both NMK, Nairobi); Masaka, Sango Bay, Katera, x. 1960 (*R. H. Carcasson*), 2 ♂ (BMNH), 1 ♂ (NMK, Nairobi).

### THE *TORTURA*-GROUP

Characterized in the male genitalia by the short, symmetrically bilobate uncus and the ventral plate of the gnathus being turned through 90 degrees, these surfaces usually in the ventral position are turned to the left side, and by the asymmetrical form of the valves. The fulcrum arises just basad of one-half of the aedeagus.

In the female genitalia the posterior margin of the lamella antevaginalis is irregularly serrate and there is a thorn-like projection from the posterior margin of the lamella postvaginalis.

### KEY TO SPECIES

- 1 Hyaline area of wings sparsely striate with grey (Pl. 123, fig. 1099). Ventral and dorsal margin of each valve produced in digitate form . . . *tortura* (p. 256)
- Hyaline area of wings suffused with grey (Pl. 123, fig. 1104). Truncate apices of valves irregularly serrate. Ventral margin of left valve with short, scobinate, apical projection . . . . . *pelobasis* (p. 256)

*Zamarada tortura* sp. n.

(Text-figs 431, 432; Pl. 90, figs 816, 817; Pl. 94, fig. 836; Pl. 123, fig. 1099)

♂ genitalia (Text-figs 431, 432). Ventral plate of gnathus strongly sclerotized and broad, apical margin shallowly excavate. Juxta strongly sclerotized with truncate apex. Apices of valves asymmetrical; apices of ventral and dorsal margins produced in digitate form; dorsal process with a very slender, setose projection fused with dorsal margin of valve at base. Aedeagus tapered. Central core of fulcrum coarsely scobinate at apex; very long sheath finely scobinate at apex. Coremata dense, dark grey (Pl. 94, fig. 836).

♀ genitalia (Pl. 90, figs 816, 817). Sterigma asymmetrical. Lamella antevaginalis covered by and fused anteriorly with a sclerotized plate, which is irregularly serrate along its posterior margin. Posterior margin of lamella postvaginalis with thorn-like projection at left side.

Measurements. Fore wing: ♂ 18–19 mm; ♀ 15–17 mm. Antennal pectinations: ♂ 6 ×, ♀ 2.5 × diameter of shaft.

Externally almost identical in colour and pattern (Pl. 123, fig. 1099) with the slightly shorter-winged *tullia*. Males may be distinguished by the presence of dark grey instead of bright buff coremata.

The male hind tibia is not dilate, but encloses a capsule of short hair-scales, similar to those found in males of the *metrioscaphes*-group.

In the male genitalia the form of the bilobate uncus turned through 90 degrees and of the valves and in the female genitalia the form of the sterigma are diagnostic.

DISTRIBUTION. Cameroun, Gabon, Angola.

Holotype ♂, CAMEROUN ('Kamerun'): Efulen, 17.vi.1922 (*H. L. Weber*), in CM, Pittsburgh.

Paratypes. CAMEROUN: Efulen, 1 (*H. L. Weber*), 2 ♂; ibidem, iii, 3 ♂; iv, 14 ♂, 3 ♀; v, 12 ♂, 3 ♀; vi, 18 ♂; 3 ♀; vii, 3 ♂; viii, 3 ♂; ix, 4 ♂, 1 ♀; x, 2 ♂, 2 ♀; xi, 5 ♂, 2 ♀; xii, 1 ♂, 2 ♀ (all CM, Pittsburgh); Epulan, 2–17.iv.1926 (*G. Schwab*), 5 ♂, (BMNH); Johann-Albrechts Höhe (*L. Conradt*), 7 ♂, 1 ♀ (BMNH); N'Kongsamba, 22.iii.1958 (*P. Darge*), 1 ♂; Fôret de Bafut Nguemba, 9 km S.E. de Bamenda, 2080 m, 3–5.iv.1972 (*C. Herbulot*), 1 ♂ (coll. Herbulot, Paris). GABON: Belinga, Piste de Mwadi, 800 m, 20.iii.1963 (*G. Bernardi*), 1 ♂ (MBG, Paris); Franceville, 29.i.1964, 1 ♂; Mouila, 5.ix.1964, 1 ♂ (both *P. Darge*, in coll. Herbulot, Paris). ANGOLA: Prov. Nordcuanza, Canzele, 30 km nördl. Quiculungo, 18.x.1957 (*Gerd Heinrich*), 1 ♂ (ZSBS, Munich).

*Zamarada pelobasis* (Prout MS) sp. n.

(Text-figs 433, 434; Pl. 90, figs 818, 819; Pl. 123, fig. 1104)

♂ ♀ (Pl. 123, fig. 1104). Greenish yellow-tinged hyaline area of wings suffused with grey, except for a slender band immediately proximad of the slender, brown, distal edging; discal spot on fore wing grey outlined in dark brown; discocellulars on hind wing slenderly grey. Non-hyaline terminal area uniformly smoke-brown (pl. 4, F2); dentate subterminal fascia broken and ill-defined in a darker shade; each distally inclined interneural, tooth-like mark edged with a few buff scales. Underside of non-hyaline terminal area uniformly smoke-grey.

The male hind tibia is simple.

♂ genitalia (Text-figs 433, 434). Ventral plate of gnathus similar to that of *tortura*. Juxta slender, apex excavate. Valves asymmetrical; truncate apical margin of each irregularly serrate; a short, scobinate projection extends from the apex of the ventral margin of the left valve.

♀ genitalia (Pl. 90, figs 818, 819). Asymmetrical lamella antevaginalis posteriorly rounded at right side, obtusely angled at left side, the whole overlaid by and fused anteriorly with a scobinate plate. Lamella postvaginalis produced medio-posteriorly and narrowly rounded.

Measurements. Fore wing: ♂ 15–18 mm; ♀ 14–17 mm. Antennal pectinations: ♂ 7 ×, ♀ 2 × diameter of shaft.

Similar in colour to *latimargo*; distinguished by the finer, grey suffusion rather than coarse striation of the hyaline area of the wings and by the much shallower and lunulate excavation of the non-hyaline terminal area of each wing between veins  $M_3$  and  $Cu_{1b}$ . In the male genitalia the form of the asymmetrical valves and in the female genitalia the form of the sterigma are diagnostic.

DISTRIBUTION. Cameroun, Gabon, Zaire, Uganda.

Holotype ♂, CAMEROUN: Efulen, 7.vi.1923 (*H. L. Weber*), in CM, Pittsburgh.

Paratypes. CAMEROUN: Efulen, 18.ii.1922 (*H. L. Weber*), 1 ♂; ibidem, 10–15.iii.1923, 2 ♂, 4 ♀; 4–19.iv.1923, 6 ♂, 1 ♀; 31.v.1922, 2 ♂, 1 ♀; 6–21.vi, 6 ♂, 4 ♀; 13.vii.1922, 1 ♂; 6–30.ix, 1 ♂, 1 ♀; 7–28.x, 1 ♂, 6 ♀; 1–21.xi, 3 ♂, 2 ♀; 8–27.xii, 4 ♂, 3 ♀ (all CM, Pittsburgh); Epulan, 17.iv.1926 (*G. Schwab*), 1 ♂; Johann-Albrechts Höhe, 9.iii.1896 (*L. Conradt*), 1 ♀ (both BMNH). GABON: Monte de Cristal, Abanga, 24.xi.1968 (*P. Darge*), 1 ♀; Mouila, 5.i.1965 (*P. Darge*), 1 ♂ (both in coll. Herbulot, Paris). ZAIRE ('Belgian Congo'): Lusambo, 14.ix.1950, 1 ♂; Sankuru, Katako-Kombe, 23.vi.1952, 1 ♂; ibidem, 19.viii.1952, 1 ♂; Uele, Paulis, 15.iv.1956, 1 ♀; ibidem, 12.vi.1958, 1 ♂ (all *Dr M. Fontaine*); Kilo, 1939, 1 ♀; Kibali-Ituri, Nioka, 23.iii.1952 (*J. Hecq*), 1 ♂ (all MRAC, Tervuren); E. Ituri Valley, 30 miles S. of Irumu, 3000 ft, vii. 1924 (*T. A. Barns*), 2 ♂, 1 ♀; Mt Hoyo, 31.x.1956 (*C. Seydel*), 1 ♀ (all BMNH). UGANDA: Bwamba, v–vi, ix (*R. Carcasson*), 4 ♂, 2 ♀ (BMNH), 4 ♂, 2 ♀ (NMK, Nairobi); Toro, Kibale Forest, v. 1966 (*R. Carcasson*), 2 ♂ (NMK, Nairobi).

### THE *CATORI*-GROUP

Externally similar in size and colour to *sagitta* in the *tullia*-group.

Characterized in the male genitalia by the form of the uncus, the apical half of which is short, slender and tapered, the basal half with lateral, shoulder-like projections. Ventral plate of gnathus strongly developed; valves symmetrical; aedeagus finely tapered; fulcrum with a dilate, scobinate apex.

In the female genitalia the sterigma is asymmetrical with the operculum at the right side. The lamella antevaginalis is overlaid by and fused anteriorly with a sclerotized plate. The lamella postvaginalis is produced posteriorly.

Both the form of the aedeagus in the male genitalia and that of the sterigma in the female genitalia shew an affinity with *tortura* and *pelobasis* and the sole species in the group, *catori* Bethune-Baker is accordingly placed next to them.



*Zamarada catori* Bethune-Baker

(Text-figs 435, 436; Pl. 94, figs 832-834; Pl. 123, fig. 1102)

*Zamarada catori* Bethune-Baker, 1913 : 573. Holotype ♂, NIGERIA (BMNH) [examined].

♂ ♀ (Pl. 123, fig. 1102). Hyaline area of wings vinaceous-tinted in oblique light, sparsely and minutely striate with brown and finely edged distally with dark brown, then silvery grey; discal spots dark brown, that on fore wing silvery grey along discocellulars, that on hind wing minute. Non-hyaline terminal area greyish orange (pl. 5, B3) lightly irrorate with brown distad of subterminal fascia, brownish orange (pl. 5, C3) proximad of it; dentate subterminal fascia light brown (pl. 5, D6) to dark brown (pl. 5, F6) slenderly edged distally with glossy buff; cilia chequered greyish orange and grey. Underside of non-hyaline terminal area greyish brown (pl. 5, E3), paler terminad.

The male hind tibia is similar to that of *sagitta* in the *tullia*-group, simple but for a short, sclerotized pocket near the femoral joint.

♂ genitalia (Text-figs 435, 436). Ventral plate of gnathus minutely scobinate and narrowly rounded at apex. Valves symmetrical; apical fourth of dorsal margin irregularly crenulate. Aedeagus finely tapered. Fulcrum with dilate, scobinate apex, a long spine at tip.

The extent of the dilate, scobinate area of the fulcrum varies. In the holotype from Nigeria it occupies one-fourth of the total length; in specimens from Cameroun it occupies up to two-fifths of the length.

♀ genitalia (Pl. 94, figs 832-834). Sterigma asymmetrical, operculum at right side. Lamella antevaginalis minutely and irregularly serrate along posterior margin, overlaid by and fused anteriorly with a sclerotized plate. Lamella postvaginalis produced posteriorly, the tip bilobate.

Measurements. Fore wing: ♂ 13-14 mm, ♀ 11-13 mm. Antennal pectinations: ♂ 14 ×, ♀ 3 × diameter of shaft.

The variegated pattern of the non-hyaline terminal area of the wings is reminiscent of *euerces* in the *metrioscaphes*-group; similar also to *sagitta* in the *tullia*-group. Distinguished from the former by its shorter wing-length and the shallower excavation of the non-hyaline terminal area of each wing. Distinguished from the similarly sized *sagitta* by the paler colour and pattern of the non-hyaline terminal area and in most examples by its smoother, non-lunulate excavation between veins  $M_3$  and  $Cu_{1b}$ ; further distinguished in the male by the longer pectinations of the antennae, which are fourteen instead of eleven times as long as the diameter of the shaft. In the male genitalia the form of the uncus and valves and in the female genitalia the form of the sterigma are diagnostic.

DISTRIBUTION. Nigeria, Cameroun.

## MATERIAL EXAMINED.

*Zamarada catori* Bethune-Baker, holotype ♂, NIGERIA: north (*D. Cator*), Geometridae genitalia slide no. 6429, in BMNH.

NIGERIA: Lagos, 2 ♀; Itu, 5.ii.1910 (*Farquahar*), 1 ♂ (all BMNH); Moor Plantation, 4 miles W. of Ibadan, c. 530 ft, 3.vii.1918 (*W. A. Lamborn*), 1 ♂ (UM, Oxford); Warri, 5.iv.1897 (*Dr Roth*), 1 ♂ (BMNH). CAMEROUN: Ndongue, 10 km S.S.W. of N'Kongsamba, 650 m, 17.x.1971, 1 ♂; Manengouba, 1040 m, 20.x.1971, 1 ♀ (both *P. Darge* in coll. Herbulot, Paris); Johann-Albrechts Höhe, 1898 (*L. Conradt*), 1 ♂; Epulan, 30.iii-17.iv.1926 (*G. Schwab*), 5 ♂, 5 ♀ (all BMNH);

Efulen, 14-20.iii.1923 (*H. L. Weber*), 3 ♂, 4 ♀; ibidem, iv, 12 ♂, 4 ♀; v, 5 ♂; vi, 2 ♂; 4.viii.1923, 2 ♂; x, 2 ♂, 1 ♀; 8.xi.1922, 2 ♀; 7.xii.1918, 1 ♀ (all CM, Pittsburgh).

### THE *EUCHARIS*-GROUP

Externally similar in colour and wing-pattern to species in the *tullia* and *tortura*-groups.

Characterized in the male genitalia by the bilobate, often asymmetrical uncus and by the broad, deep ventral plate of the gnathus, sometimes asymmetrical in form. The valves are either symmetrical or asymmetrical. The fulcrum arises just basad of one-half of the aedeagus.

Characterized in the female genitalia by the very strongly sclerotized cone-like sterigma, often with a tapered projection from the posterior margin, enclosing the operculum and ductus bursae.

#### KEY TO SPECIES

- |       |                                                                                                                                                                                                                            |                           |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| 1     | Less than one-half of each wing hyaline . . . . .                                                                                                                                                                          | <i>opala</i> (p. 265)     |
| —     | More than two-thirds of each wing hyaline . . . . .                                                                                                                                                                        | 2                         |
| 2 (1) | Hyaline area of wings pearl-coloured . . . . .                                                                                                                                                                             | <i>eryma</i> (p. 259)     |
| —     | Hyaline area of wings tinged with yellow or green . . . . .                                                                                                                                                                | 3                         |
| 3 (2) | Uncus symmetrical . . . . .                                                                                                                                                                                                | 4                         |
| —     | Uncus asymmetrical . . . . .                                                                                                                                                                                               | 5                         |
| 4 (3) | Shallowest depth of ventral plate of gnathus (measured from apical to basal margins) equal to or greater than greatest width of aedeagus (Text-fig. 439).<br>Ventral and dorsal margins of valve almost parallel . . . . . | <i>eucharis</i> (p. 260)  |
| —     | Shallowest depth of ventral plate of gnathus equal to one-half greatest width of aedeagus (Text-fig. 441). Dorsal margin of valve sinuous, apical fourth of valve narrowed to one-fifth of width of base . . . . .         | <i>volSELLA</i> (p. 262)  |
| 5 (3) | Right valve slenderly produced to acicular apex, incurved towards uncus (Text-fig. 443) . . . . .                                                                                                                          | <i>deformata</i> (p. 262) |
| —     | Valve not so formed . . . . .                                                                                                                                                                                              | 6                         |
| 6 (5) | Ventral and dorsal margins of right valve produced in acicular form. Right lobe of uncus twice as broad as left lobe (Text-fig. 445). . . . .                                                                              | <i>mimesis</i> (p. 263)   |
| —     | Ventral margin of right valve irregularly and diagonally inclined to tapered apex of dorsal margin. Left lobe of uncus produced to acicular apex; right lobe atrophied . . . . .                                           | <i>variola</i> (p. 264)   |

### *Zamarada eryma* (Prout MS) sp. n.

(Text-figs 437, 438; Pl. 91, figs 820, 821; Pl. 122, fig. 1095)

♂ ♀ (Pl. 122, fig. 1095). Hyaline area of wings pearl-coloured, sparsely irrorate with grey along posterior margins and finely edged distally with brown; discal spot on fore wing dark brown, sometimes grey at centre, that on hind wing minute and brown, when present. Non-hyaline terminal area light brown (pl. 7, D<sub>4</sub>) to greyish brown (pl. 7, E<sub>3</sub>) proximad of the darker, heavily marked, brownish grey (pl. 7, F<sub>2</sub>), dentate subterminal fascia, which is finely edged distally with glossy buff; distad of the fascia the wing is light brown to greyish brown irrorate with brownish grey. Underside of non-hyaline terminal area uniformly brownish grey.

The male hind tibia is dilate with a longitudinal fold one-half as long as the tibia and a

short tuft of hair-scales, equal in length to greatest width of tibia, arising at joint with femur.

♂ genitalia (Text-figs 437, 438). Uncus symmetrical and bilobate. Ventral plate of gnathus broad and of even depth, strongly sclerotized. Valves slightly asymmetrical. Aedeagus smooth and tapered. Fulcrum sparsely scobinate apicad.

♀ genitalia (Pl. 91, figs 820, 821). Ductus bursae enclosed in a strongly sclerotized, truncate cone-like sterigma, the operculum at the apex; a short, thorn-like projection from middle of posterodorsal margin. Corpus bursae weakly ribbed and sclerotized posteriorly.

Measurements. Fore wing: ♂ 18–19 mm; ♀ 16.5–17.5 mm. Antennal pectinations: ♂ 7 ×, ♀ 5 × diameter of shaft.

Reminiscent of *perlepidata* and *terpsichore* in the *perlepidata*-group, in the pearl-coloured, almost white hyaline area of the wings, but differing in pattern, the combination being diagnostic. In the male genitalia the form of the valves and of the fulcrum and in the female genitalia the form of the sterigma are diagnostic.

DISTRIBUTION. Cameroun, Gabon.

Holotype ♂, CAMEROUN ('Kamerun'): Efulen, 24.x.1913 (*H. L. Weber*), in CM, Pittsburgh.

Paratypes. CAMEROUN: Yabassi Dist., lat. 4° N. 10° E., xii. 1937, dry season (*F. G. Merfield*), 1 ♀ (BMNH); N'Kongsamba, 14.v.1958 (*P. Darge*), 1 ♂; 8 km N. d'Edea, 7.iv.1970 (*C. Herbulot*), 1 ♂ (both coll. Herbulot, Paris); Efulen, 9–10.i (*H. L. Weber*), 3 ♂; ibidem, 15–20.ii, 2 ♂; 10–24.iii, 1 ♂, 2 ♀; 5–24.iv, 6 ♂, 1 ♀; v–vii, 4 ♂; 11–26.x, 10 ♂, 1 ♀; 9–16.xi, 5 ♂; 10–30.xii, 7 ♂; Lolodorf, xi. 1931, 1 ♂ (all CM, Pittsburgh). GABON: Rive dr. du Iézé, N. de Mwadi, 5.iv.1963 (*G. Bernardi*), 1 ♂ (MBG, Paris); Ile de Lambirini, xii. 1916–i. 1917, 1 ♂; Lambarené, Ogove R., ix. 1907 (*Dr Ansorge*), 1 ♀; Ogove, 1888 (*Bosch*), 1 ♀ (all BMNH); Ogové River, Kangwé (*A. C. Good*), 1 ♀ (CM, Pittsburgh); Franceville, 11.ix.1963, 1 ♂; Mouila, 30.ix–5.x.1964, 2 ♂ (all *P. Darge*, in coll. Herbulot, Paris).

### *Zamarada eucharis* (Drury)

(Text-figs 439, 440; Pl. 91, figs 822, 823; Pl. 122, fig. 1096)

[*Phalaena*] *Noctua eucharis* Drury, 1782: index, 31, pl. 22, fig. 6. NEOTYPE ♂, SIERRA LEONE (BMNH), here designated [examined].

♂ ♀ (Pl. 122, fig. 1096). Hyaline area of wings tinged with green, sparsely irrorate proximally with grey and finely edged distally with dark brown; a small discal spot on fore wing, dark grey with light grey scales medially; discocellulars on hind wing unmarked. Non-hyaline terminal area greyish brown (pl. 7, E3) irrorate with a very dark, brownish grey (pl. 7, F2) distad of strongly marked, dentate subterminal fascia, also dark brownish grey. Underside of non-hyaline terminal area uniformly brownish grey.

Male hind tibia similar to that of *eryma*.

♂ genitalia (Text-figs 439, 440). Uncus and gnathus similar to those of *eryma*, but ventral plate of gnathus deeper. Valves asymmetrical; ventral and dorsal margins almost parallel; apical half of dorsal process similar to that of *eryma*. Aedeagus tapered and smooth. Fulcrum longer than that of *eryma*, coarsely scobinate apicad.

♀ genitalia (Pl. 91, figs 822, 823). Ductus bursae enclosed in a strongly sclerotized cone-like sterigma, the ventral surface of which is densely scobinate and bears two semi-circular folds anteriorly; a short, thorn-like projection from posterior margin of sterigma.

Measurements. Fore wing: ♂ 17.0–18.5 mm; ♀ 17.0–17.5 mm. Antennal pectinations: ♂ 8 ×, ♀ 3 × diameter of shaft.

Closely similar in colour and wing-pattern to *emaciata*; series of the two species shew that in *eucharis* the hyaline area is greener-tinged, less striate and the discal spots smaller. Single specimens are best determined by the genitalia, which in both sexes are diagnostic.

Drury's original description of *eucharis* records the type locality as Brasil and the wing-span as 'more than one inch and a half'; the measurement of the type would probably have been only fractionally greater, for Drury recorded wing measurements to the nearest eighth of an inch, sometimes 'almost an eighth'. The figure, measuring one and three-quarter inches, probably represents an enlargement.

Wing-span, colour and pattern of Drury's figure of *eucharis* accord closely with several species of *Zamarada* occurring in Sierra Leone, whence Drury received the majority of the African insects described and figured in volume 3 of his Exotic Insects; no species resembling *eucharis* is known from the Antilles or from S. America.

According to Horn & Kahle (1935 : 62), the Lepidoptera types from the Drury collection passed to the BMNH from the Milne collection; no specimen of *Zamarada* has been found in the BMNH that could have come from the Drury collection. In order to stabilize the name in a group of several similarly patterned species, each according well with Drury's figure of *eucharis*, a neotype has been designated.

DISTRIBUTION. W. Africa, Guinea to Nigeria.

#### MATERIAL EXAMINED.

*Zamarada eucharis* Drury, neotype ♂, SIERRA LEONE: Bo, 10.i.1958 (R. Taylor), Geometridae genitalia slide no. 7830, in BMNH.

GUINEA: Massadou, near Macenta, 1600 ft, 13–17.v.1926, 1 ♂; Macenta, 2000 ft, v. 1926, 1 ♂, 1 ♀ (all C. L. Collenette). SIERRA LEONE: Freetown, x–xi. 1968 (D. F. Owen), 1 ♂; Moyamba (D. Cator), 1 ♂; Bo, 10.i.1958 (R. Taylor), 1 ♂; Bambawo, 13.vi.1969 (R. J. Revell), 1 ♂ (all BMNH). LIBERIA: Nimba, Grassfield, vi–vii. 1967 (A. Forbes-Watson), 1 ♂ (NMK, Nairobi); Marshall Territory, Harbel, 19.ix.1955 (R. M. Fox), 1 ♂ (CM, Pittsburgh). IVORY COAST: Bingerville, 15–23.v.1915 (G. Melou), 1 ♂; ibidem, 1–3.vii.1915, 1 ♂ (both BMNH); Bingerville, 1.xii.1961 (J. Decelle), 1 ♂ (MRAC, Tervuren); Lamto, 36 km N.N.W. of Tiassalé, 20–23.iv.1969, 2 ♂; Yapo-Sud, 22 km S.S.E. of Agboville, 12–18.iv.1969, 2 ♀ (all C. Herbulot, in coll. Herbulot, Paris); Gopoupleu près Danané, 8.i.1959 (R. Condamin & R. Roy), 1 ♂ (IFAN, Dakar). GHANA: 1 ♂; Wassaw, 45 miles inland from Sekondi, 1 ♂. NIGERIA: (J. Boorman), 3 ♂; Ilesha (L. E. H. Humfrey), 1 ♂, 1 ♀; Ikom, 24.ii.1930 (E. F. G. Haig), 1 ♂.



*Zamarada volsella* sp. n.

(Text-figs 441, 442; Pl. 92, figs 824, 825)

♂ genitalia (Text-figs 441, 442). Uncus bilobate, the lobes more widely separated at base than in *eucharis*. Ventral plate of gnathus asymmetrical, shallower in depth than *eucharis*. Valves usually symmetrical and narrowed apicad; apex of left valve occasionally with second thorn-like projection; dorsal process weakly spined. Fulcrum dilate and coarsely scobinate at apex.

♀ genitalia (Pl. 92, figs 824, 825). Ductus bursae enclosed in a strongly sclerotized, asymmetrical sterigma, the ventral surface of which is scobinate and bears a transverse, posteriorly bilobate fold on anterior margin; a short, smoothly tapered, digitate projection extends from left side of posterior margin of sterigma.

Measurements. Fore wing: ♂ 15.0–17.5 mm; ♀ 16 mm. Antennal pectinations: ♂ 7 ×, ♀ 3 × diameter of shaft.

Apparently indistinguishable on external features from *eucharis*; their respective distributions do not, however, appear to overlap. In the male genitalia the form of the valves, the shallower, asymmetrical ventral plate of the gnathus and the apically dilate fulcrum and in the female genitalia the form of the strongly sclerotized sterigma are diagnostic.

DISTRIBUTION. Cameroun, Gabon, Zaire.

Holotype ♂, CAMEROUN ('Kamerun'): Efulen, 21.vi.1922 (*H. L. Weber*), in CM, Pittsburgh.

Paratypes. CAMEROUN: Johann-Albrechts Höhe (*L. Conradt*), 1 ♂ (BMNH); 8 km N. d'Edea, 8–9.iv.1970 (*C. Herbulot*), 1 ♂; M'Balmayo, Ecole forestière, 7.x.1971 (*P. Darge*), 1 ♂ (both coll. Herbulot, Paris); Lolodorf (*L. Conradt*), 2 ♂ (BMNH); Lolodorf, ix. 1930–i. 1931, 1 ♂ (CM, Pittsburgh); Efulen, 13–19.iii.1923 (*H. L. Weber*), 1 ♂, 2 ♀; ibidem, iv, 3 ♂; v, 4 ♂; vi, 5 ♂; vii, 1 ♂; x, 8 ♂; xi, 6 ♂; xii, 2 ♂ (all CM, Pittsburgh). GABON: Belinga, Camp Central, 700 m, 14.v.1963 (*G. Bernardi*), 1 ♂ (MBG, Paris). ZAIRE ('Belgian Congo'): Sankaru, Katoko-Kombe, 11.ix.1952 (*Dr M. Fontaine*), 1 ♂ (MRAC, Tervuren); Prov. Orientale, Opala, Lomami River, iii. 1959 (*R. H. Carcasson*), 1 ♂, 1 ♀ (BMNH); W. Kivu, near Masisi, Upper Lowa Valley, 5–6000 ft, forest and long grass, ii. 1924, wet season (*T. A. Barns*), 1 ♂; Middle Lowa Valley, near Walikali, 3–4000 ft, forest, ii. 1924 (*T. A. Barns*), 1 ♂ (both BMNH).

*Zamarada deformata* sp. n.

(Text-figs 443, 444; Pl. 92, figs 826, 827; Pl. 123, fig. 1103)

♂ ♀ (Pl. 123, fig. 1103). Externally closely similar to smaller examples of *paxilla*, with which it occurs. Distinguished in both sexes by the shorter antennal pectinations, which are five times instead of eight times as long as the diameter of the shaft in the male and twice as long instead of four times as long as the diameter of the shaft in the female. The male may be further distinguished by the absence of long, fringing hair-scales on the hind femur; the hind tibia is dilate with a short-scaled, longitudinal pocket, three-fourths as long as the tibia.

♂ genitalia (Text-figs 443, 444). Uncus asymmetrical and irregularly bilobate. Ventral plate of gnathus grossly asymmetrical and minutely scobinate. Valves asymmetrical, twin

apices on left side tapered to narrowly rounded tips, single apex on right side finely tapered to acicular tip. Aedeagus with slight, semi-circular projection at one-half. Fulcrum scobinate at apex.

♀ genitalia (Pl. 92, figs 826, 827). Ductus bursae enclosed in a short, strongly sclerotized, truncate cone-like sterigma; ventral surface with a semi-circular fold at anterior margin and a short, digitate projection at right side of posterior margin.

The form of the genitalia of both sexes is diagnostic.

Measurements. Fore wing: ♂ ♀ 15 mm. Antennal pectinations: ♂ 5 ×, ♀ 2 × diameter of shaft.

DISTRIBUTION. E. Zaire.

Holotype ♂, ZAIRE ('Belgian Congo'): Middle Lowa Valley, near Walikali, 3–4000 ft, forest, ii. 1924, wet season (*T. A. Barns*), Geometridae genitalia slide no. 7659, in BMNH.

Paratypes. ZAIRE ('Belgian Congo'): W. Kivu, Upper Lowa Valley, near Masisi, 5–6000 ft, forest and long grass, ii. 1924 (*T. A. Barns*), 2 ♀ (BMNH).

### *Zamarada mimesis* sp. n.

(Text-figs 445, 446; Pl. 93, figs 828, 829)

[*Zamarada thalia* Oberthür, 1912 : 260, 351, pl. 153, fig. 1471, paralectotype; nec fig. 1470, lectotype. Misidentification.]

♂ genitalia (Text-figs 445, 446). Uncus bilobate and asymmetrical. Ventral plate of gnathus strongly sclerotized and minutely scobinate, asymmetrical in form. Valves usually symmetrical, apex of ventral arm bearing long, stiff setae. Aedeagus tapered, dorsal surface minutely scobinate at three-fourths. Coremata bright buff.

♀ genitalia (Pl. 93, figs 828, 829). Posterior half of ductus bursae sclerotized, more at right side than left, and enclosed in a smoothly sclerotized, asymmetrical collar, the posterior ventral margin of which is sinuous.

Measurements. Fore wing: ♂ 16–19 mm; ♀ 16.0–16.5 mm. Antennal pectinations: ♂ 7 ×, ♀ equal in length to diameter of shaft.

Externally almost identical with *paxilla*; distinguished in the male by the absence of long, fringing hair-scales from the hind femur and in the female by the very short antennal pectinations. The form of the genitalia of both sexes is diagnostic.

DISTRIBUTION. W. Africa, Guinea to Gabon, Zaire.

Holotype ♂, CAMEROUN ('Kamerun'): Efulen, 23.x.1922 (*H. L. Weber*), in CM, Pittsburgh).

Paratypes. GUINEA: Guéckédou (*I. Korecká*), 1 ♂ (MM, Brno); Massadou, near Macenta, 1600 ft, 13–17.v.1926 (*C. L. Collenette*), 1 ♂ (BMNH). SIERRA LEONE: 2 ♂, 1 ♀ (BMNH), 1 ♂ (UM, Oxford); Freetown, ii. 1949 (*W. Peters*), 1 ♂ (BMNH). IVORY COAST: Lamto, 36 km N.N.W. of Tiassalé, 20–23.iv.1969, 1 ♂; Yapo-Sud, 22 km S.S.E. of Agboville, 12–18.iv.1969, 1 ♂ (both *C. Herbulot* in coll. Herbulot, Paris). GHANA: Sekondi, 1 ♂ (BMNH). NIGERIA: (*J. Boorman*), 1 ♂; Lagos, 1 ♂ (both BMNH); Moor Plantation, 4 miles W. of Ibadan, c. 530 ft,

10.vii.1913 (*W. A. Lamborn*), 1 ♂ (UM, Oxford); Mambilla Plateau, Karmantan Forest, c. 5500 ft, 10.xii.1968 (*H. Roberts*), 1 ♂ (BMNH). CAMEROUN: 8 km N. d'Edea, 30.iii-1.iv.1970 (*C. Herbulot*), 1 ♂; ibidem, 12.iv.1970 (*C. Lemaire*), 1 ♀ (both coll. Herbulot, Paris); Lolodorf (*L. Conradt*), 1 ♀ (*Zamarada thalia* Oberthür, fig. 1471, paralectotype; misidentification; in BMNH). Efulen, i, iii-vi, x-xi (*H. L. Weber*), 13 ♂, 1 ♀ (all CM, Pittsburgh). GABON: Belinga, Piste de Mwadi, 800 m, 20.iii.1963 (*G. Bernardi*), 1 ♂ (MBG, Paris); Mouila ix-x. 1964 (*P. Darge*), 2 ♂, 1 ♀ (all coll. Herbulot, Paris). ZAIRE ('Belgian Congo'): Luluabourg, 24.viii.1955 (*C. Seydel*), 1 ♂; ibidem, 19.vii.1957, 1 ♂ (both BMNH); Sankaru, Katako-Kombe, 14.ix.1952 (*Dr M. Fontaine*), 1 ♂ MRAC, Tervuren; Mt Hoyo, 12.xi.1956 (*C. Seydel*), 1 ♂ (BMNH); Kilomines, 1939 (*Lepersonne*), 1 ♂ (MRAC, Tervuren).

### *Zamarada variola* sp. n.

(Text-figs 447, 448; Pl. 93, figs 830, 831; Pl. 123, fig. 1098)

♂ ♀ (Pl. 123, fig. 1098). Hyaline area of wings greenish tinged and coarsely striate with grey, the grey being vinaceous tinged in oblique light; distal margin of hyaline area without slender, dark, marginal line; discal spots grey, that on fore wing large with a few light scales medially. Non-hyaline terminal area uniformly brownish grey (pl. 5, E2, elephant-skin grey); subterminal fascia indicated only by small, slightly darker grey, interneural spots, each edged distally with a few buff scales. Underside of non-hyaline terminal area uniformly brownish grey.

In the male the hind tibia is dilate with a short-scaled, longitudinal pocket.

♂ genitalia (Text-figs 447, 448). Uncus asymmetrical; left lobe produced to acicular apex, right lobe atrophied. Ventral plate of gnathus asymmetrical and strongly sclerotized, with a long, scobinate, tongue-like process at right side. Valves asymmetrical. Aedeagus tapered and scobinate along left side at three-fourths. Fulcrum broadened and scobinate apicad.

Coremata buff.

♀ genitalia (Pl. 93, figs 830, 831). Collar-like sterigma asymmetrical, more broadly developed at right side where sclerotized ductus bursae is attached, and overlaid along anterior margin by a bilobate fold; a small hemi-spherical, sclerotized area at mid-posterior margin.

Measurements. Fore wing: ♂ 20-22 mm; ♀ 18-21 mm. Antennal pectinations: ♂ 7 ×, ♀ 5 × diameter of shaft.

Similar in colour and pattern to *latimargo*, but differing in the greenish-tinged hyaline area and the absence of a slender, dark brown distal margin to the area. Males may be further distinguished from *latimargo* by the absence of long hair-scales on the hind leg. In the male genitalia the form of the uncus, ventral plate of the gnathus and valves and in the female genitalia the form of the sterigma are diagnostic.

DISTRIBUTION. Cameroun, Gabon, Zaire, Uganda.

Holotype ♂, UGANDA: Masaka, Sango Bay, Katera, x. 1960 (*R. H. Carcasson*), Geometridae genitalia slide no. 7822, in BMNH.

Paratypes. CAMEROUN: Efulen, 27.xii.1921 (*H. L. Weber*), 1 ♂ (CM, Pittsburgh). GABON: Belinga, Camp Central, 500 m, 25.iii.1963, 1 ♂; ibidem, 700 m, 2.vi.1963, 1 ♂; Makokou, Colline Mission biologique, 17.xi.1967, 1 ♂ (all *G. Bernardi*, in

MBG, Paris). ZAIRE ('Belgian Congo'): Kasai, xii. 1923, 1 ♂ (BMNH); Prov. Orientale, Opala, Lomami River, iii. 1959 (*R. H. Carcasson*), 1 ♂ (NMK, Nairobi); Itoko à Gombé (*L. Verlaine*), 1 ♂ (MRAC, Tervuren); Ukakuraka, 20.xii.1948 (*T. Wikeley*), 1 ♂ (BMNH); Kibali-Ituri, Nioka, 16.vii.1952 (*J. Hecq*), 1 ♂ (MRAC, Tervuren). UGANDA: holotype data, 1 ♂ (NMK, Nairobi), 2 ♀ (BMNH).

### *Zamarada opala* Carcasson

(Text-figs 449, 450; Pl. 79, figs 771, 772; Pl. 123, fig. 1097)

*Zamarada opala* Carcasson, 1964 : 54, pl. 1, figs 4, 5; pl. 7, figs 57, 58. Holotype ♂, ZAIRE (BMNH) [examined].

♂ ♀ (Pl. 123, fig. 1097). Hyaline area of wings tinged with yellow and finely edged with brown both proximally and distally. Non-hyaline areas a pale brownish orange (pl. 6, C3) irrorate with brownish orange (pl. 6, C6, caramel-brown) as shewn in figure; dentate subterminal fascia greyish orange; cilia chequered buff and brown. Underside of non-hyaline terminal area brown (pl. 6, E5), greyish brown terminad.

The male hind tibia is dilate with a short-scaled, longitudinal pocket, three-fourths as long as the tibia.

♂ genitalia (Text-figs 449, 450). Uncus bilobate and symmetrical. Ventral plate of gnathus strongly sclerotized and deep, apex narrowly rounded and scobinate. Valves asymmetrical. Aedeagus tapered, with a short, broadly rounded projection at one-half. Fulcrum reduced and slender, one-half as long as aedeagus and scobinate at apex.

♀ genitalia (Pl. 79, figs 771, 772). Sterigma forming strongly sclerotized collar round operculum, posterior margin bilobate; ductus bursae sclerotized posteriorly.

Measurements. Fore wing: ♂ 20–22 mm; ♀ 20.0–20.5 mm. Antennal pectinations: ♂ 7 ×, ♀ 2 × diameter of shaft.

Distinct in colour and pattern; the genitalia of both sexes are also diagnostic. Associated with the *eucharis*-group because of the bilobate uncus, strongly developed ventral plate of the gnathus and the asymmetrical valves.

DISTRIBUTION. Cameroun, Zaire.

#### MATERIAL EXAMINED.

*Zamarada opala* Carcasson, holotype ♂, ZAIRE ('Belgian Congo'): Prov. Orientale, Lomami River, Opala, iii. 1959 (*R. H. Carcasson*), Geometridae genitalia slide no. 5634, in BMNH.

CAMEROUN: Lolodorf (*L. Conradt*), 1 ♀ (BMNH); Efulen, 11.x.1922 (*H. L. Weber*), 1 ♂ (CM, Pittsburgh). ZAIRE ('Belgian Congo'): holotype data, 1 ♀ (*Zamarada opala* Carcasson, paratype, in BMNH); Sankaru, Katako-Kombe, 18.ix.1952 (*Dr M. Fontaine*), 1 ♂ (MRAC, Tervuren).

#### THE WEBERI-GROUP

Characterized in the male genitalia by the bilobate uncus, the asymmetrical but simple valves and their reduced, asymmetrical dorsal processes, each dilate and setose at apex, but without a basal projection.



Structurally remote from any species so far known in the genus and placed arbitrarily after the *eucharis*-group because of general similarity of colour and wing-pattern.

***Zamarada weberi* sp. n.**

(Text-figs 451, 452; Pl. 123, fig. 1100)

♂ (Pl. 123, fig. 1100). Hyaline area of wings tinged with pearl colour, having a vinaceous tint in oblique light; posterior margins very sparsely striate with brown, distal margin slenderly sepia; discal spot on fore wing sepia, pale grey on discocellulars, that on hind wing minute. Non-hyaline terminal area greyish brown (pl. 5, E3, mouse-grey) irrorate with sepia (pl. 5, F4); strongly marked subterminal fascia sepia very finely edged distally with buff; terminal, interneural spots sepia. Underside of non-hyaline terminal area uniformly greyish brown.

♂ genitalia (Text-figs 451, 452). Uncus broad and bilobate. Ventral plate of gnathus broad and deep, margin irregularly and minutely scobinate. Valves simple, but asymmetrical; dorsal processes broadened and setose at apex, the two asymmetrical; no setose projection at base. Aedeagus finely tapered; a diagonally transverse ridge at one-third. Fulcrum scobinate and rasp-like in membranous sheath. No cornutus.

♀ unknown.

Measurements. Fore wing: ♂ 12.5–13.0 mm. Antennal pectinations: ♂ 7 × diameter of shaft.

Externally distinct in size, colour and pattern. In the male genitalia the form of the uncus and valves is diagnostic.

Holotype ♂, CAMEROUN ('Kamerun'): Efulen, 3.vi.1922 (*H. L. Weber*), in CM, Pittsburgh.

Paratypes. CAMEROUN: Efulen, 6.vi.1923 (*H. L. Weber*), 1 ♂; ibidem, 5.ix.1912, 1 ♂; 13.xii.1924, 1 ♂ (all CM, Pittsburgh); Nlong, 18.i.1953 (*R. P. Boetsch*), 1 ♂ (coll. Herbulot, Paris).

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- 1899. New Drepanulidae, Thyrididae and Geometridae from the Aethiopian region. *Novit. zool.* **6** : 287-312.
- 1901. Drepanulidae, Thyrididae, Epiplemidæ and Geometridae from the Aethiopian region. *Novit. zool.* **8** : 202-217.
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- 1902a. New African Drepanulidae, Thyrididae, Epiplemidæ and Geometridae in the Tring Museum. *Novit. zool.* **9** : 487-536.
- 1905. New African Thyridae, Uraniidae and Geometridae. *Novit. zool.* **12** : 380-409.
- 1907. New Drepanulidae, Thyrididae, Uraniidae and Geometridae from British New Guinea. *Novit. zool.* **14** : 97-186.
- 1907a. American Thyrididae, Uraniidae and Geometridae in the Tring Museum. *Novit. zool.* **14** : 187-323.
- 1909. New species of Uraniidae and Geometridae from the Aethiopian region. *Novit. zool.* **16** : 110-122.
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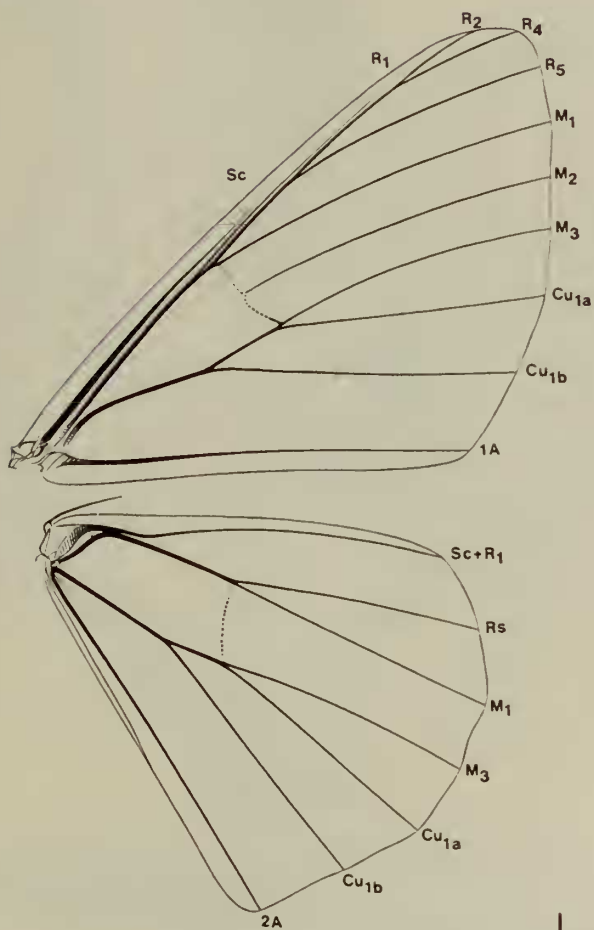
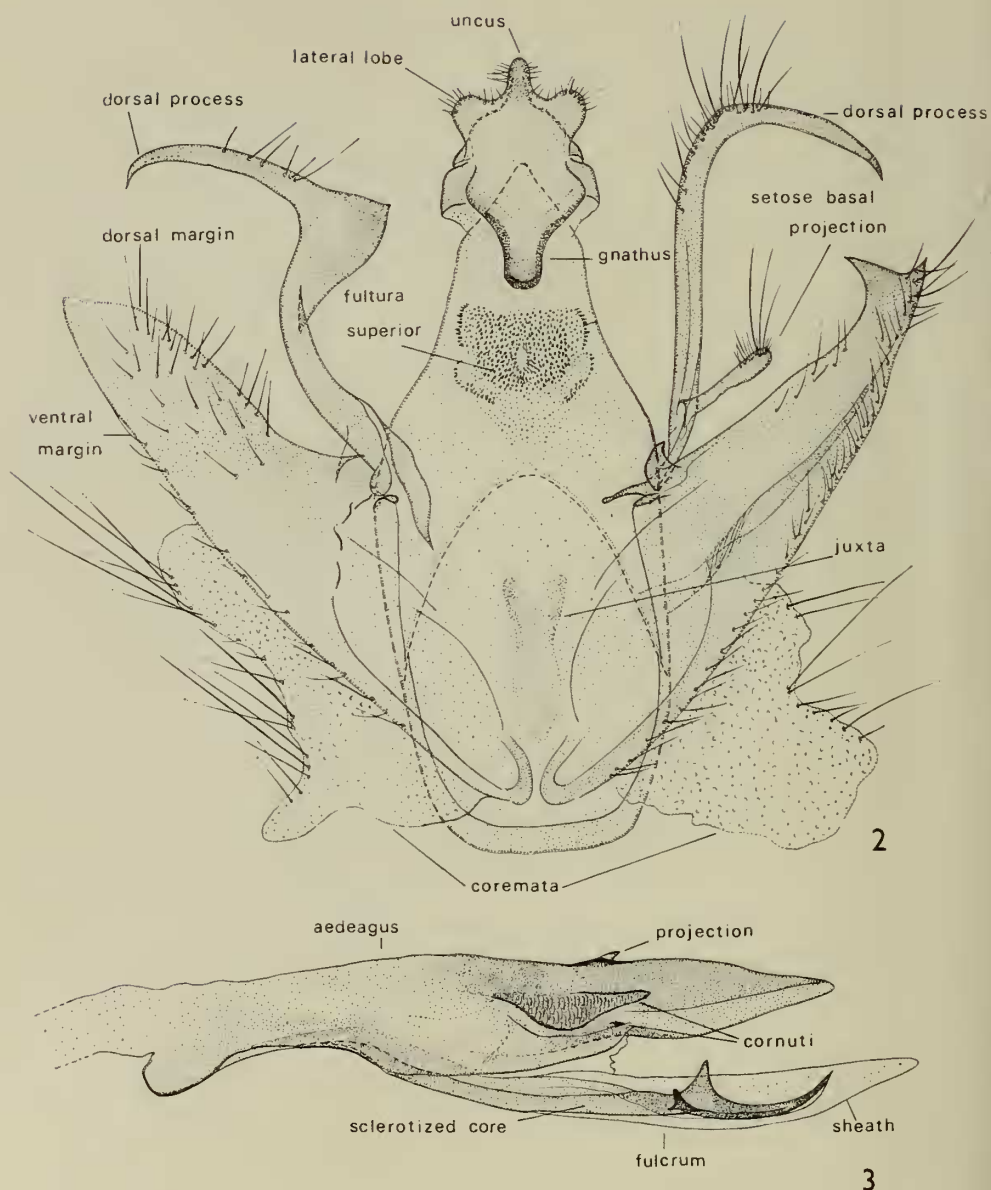


FIG. 1. *Zamarada translucida*, venation (A. S.)



FIGS 2, 3. *Zamarada*, fabricated genitalia (M.L.). 2, ♂, 3, aedeagus.

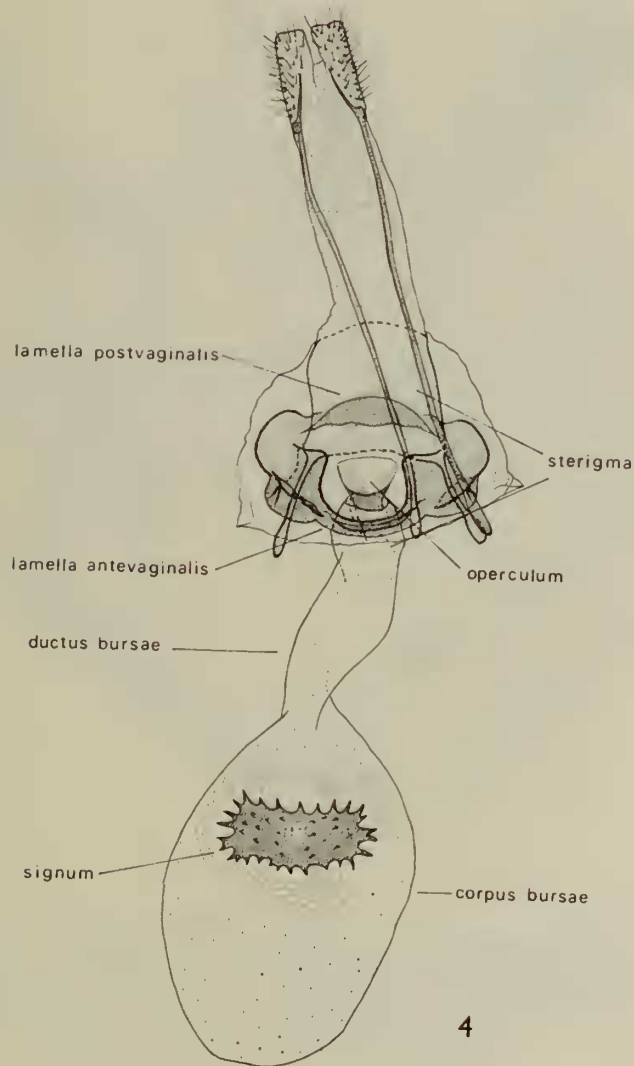
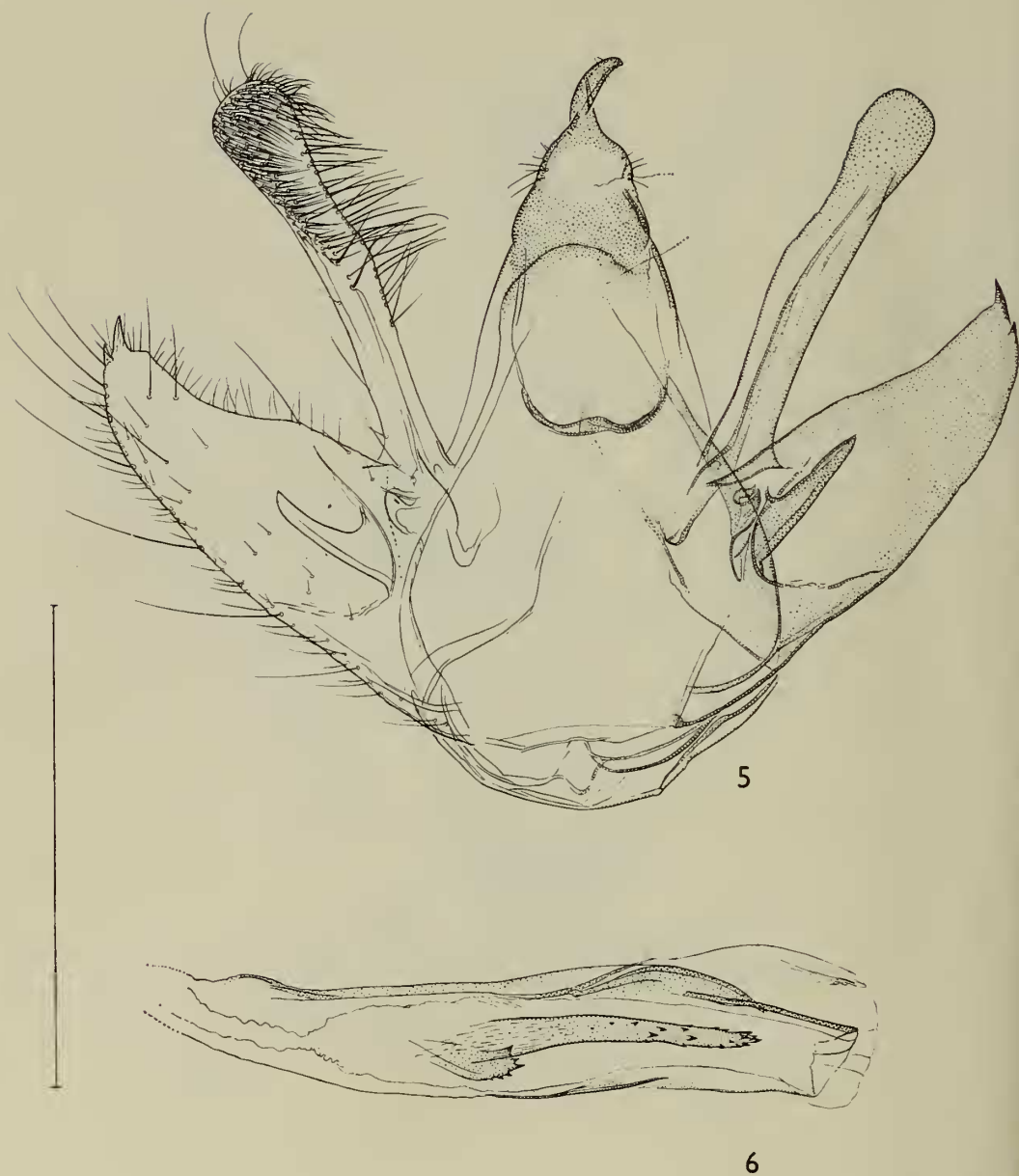


FIG. 4. *Zamarada*, fabricated genitalia (M.L.). ♀.

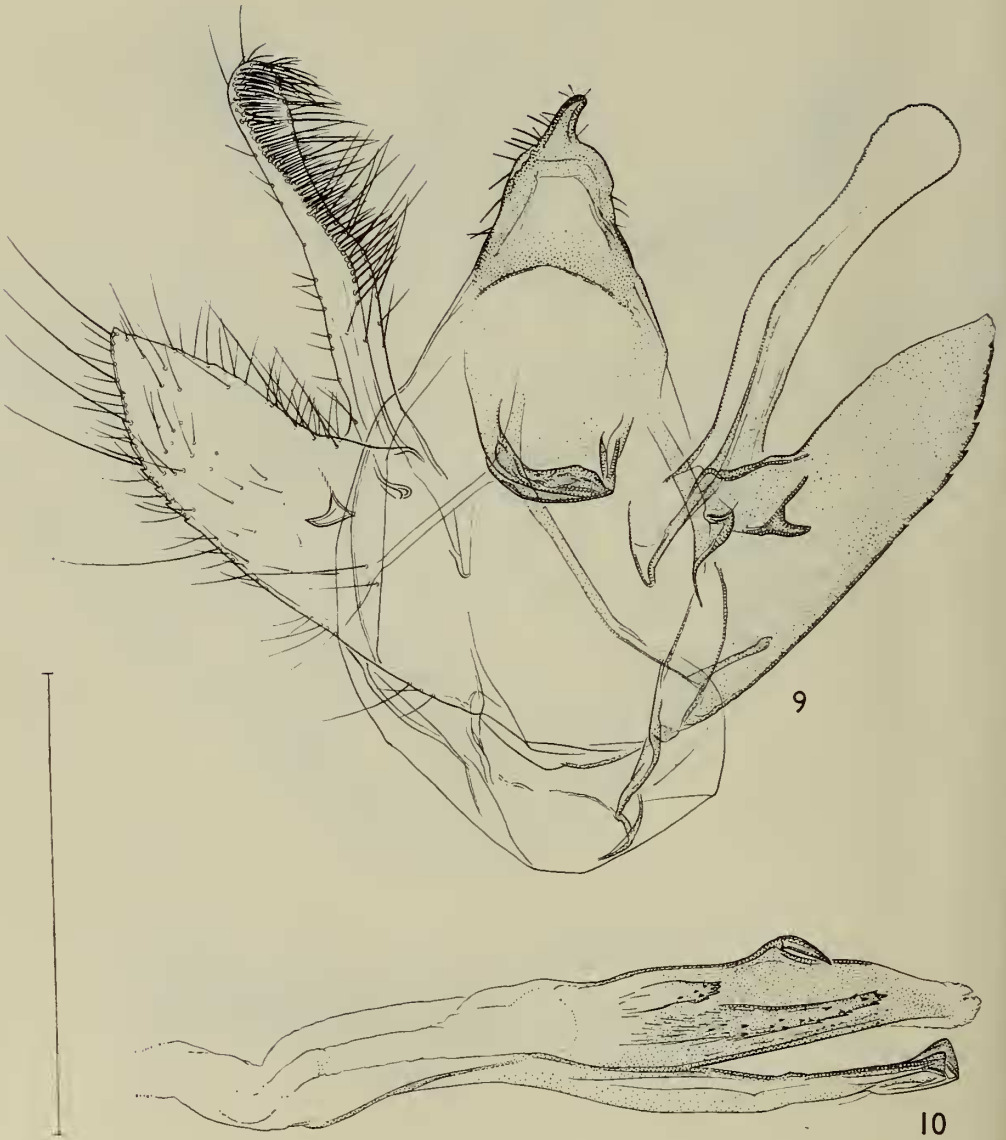




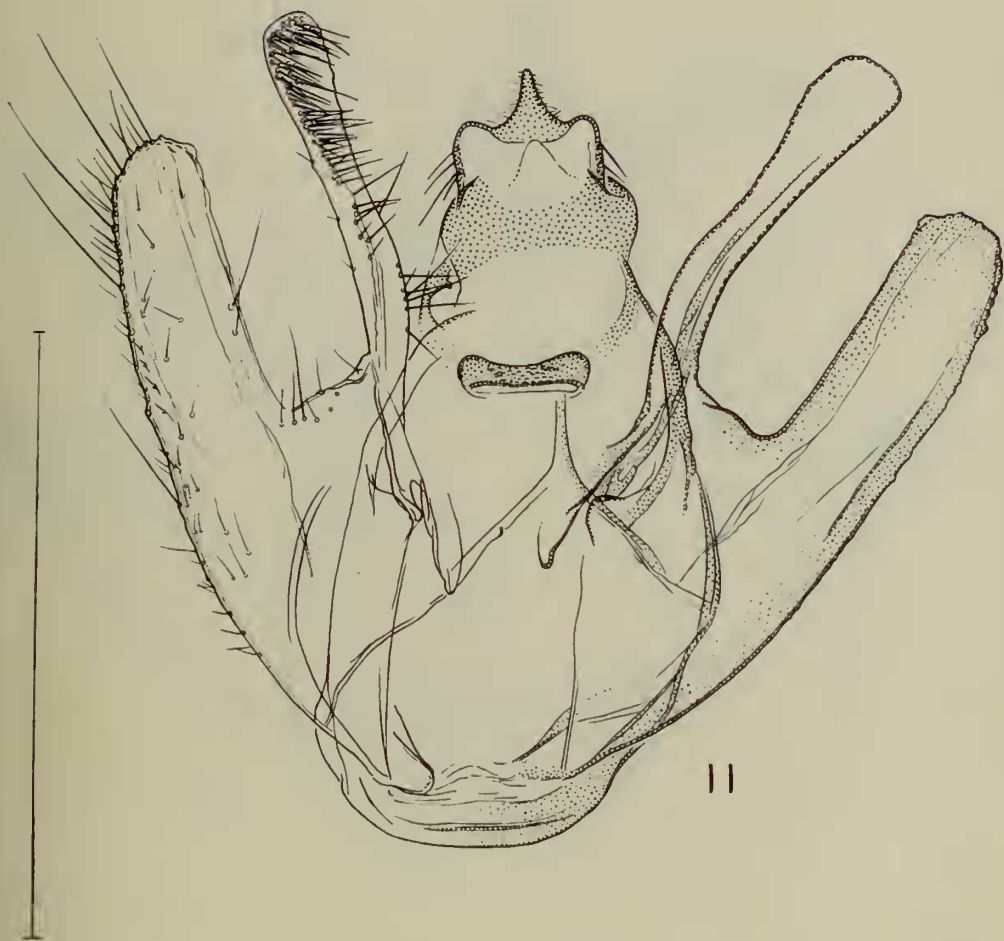
FIGS 5, 6. *Zamarada keraia*, genitalia (A.S.). 5, ♂; 6, aedeagus.



FIGS 7, 8. *Zamarada keraia* ?subsp., genitalia (A.S.). 7, ♂; 8, aedeagus.



FIGS 9, 10. *Zamarada ekphysis*, genitalia (A.S.). 9, ♂; 10, aedeagus.



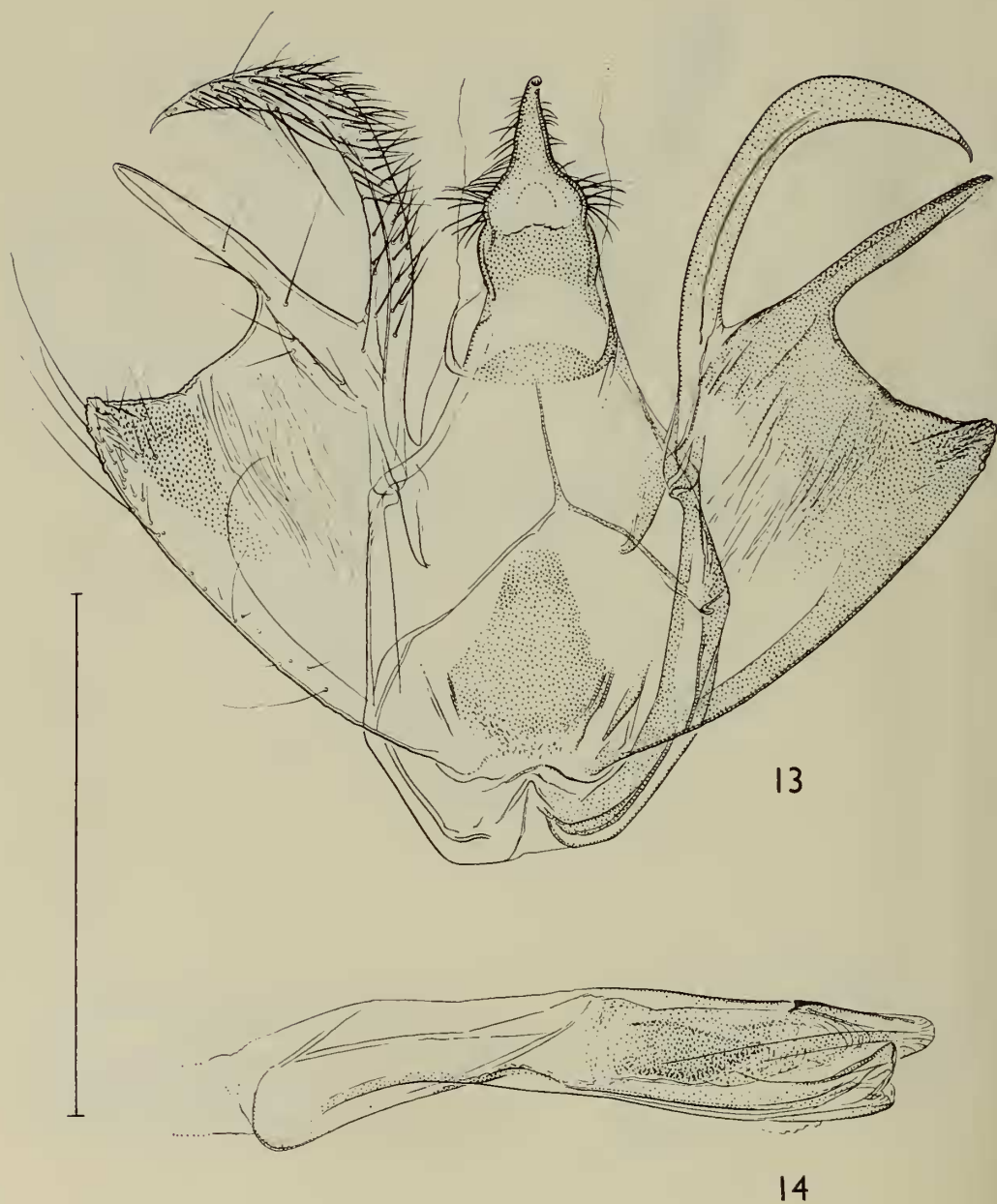
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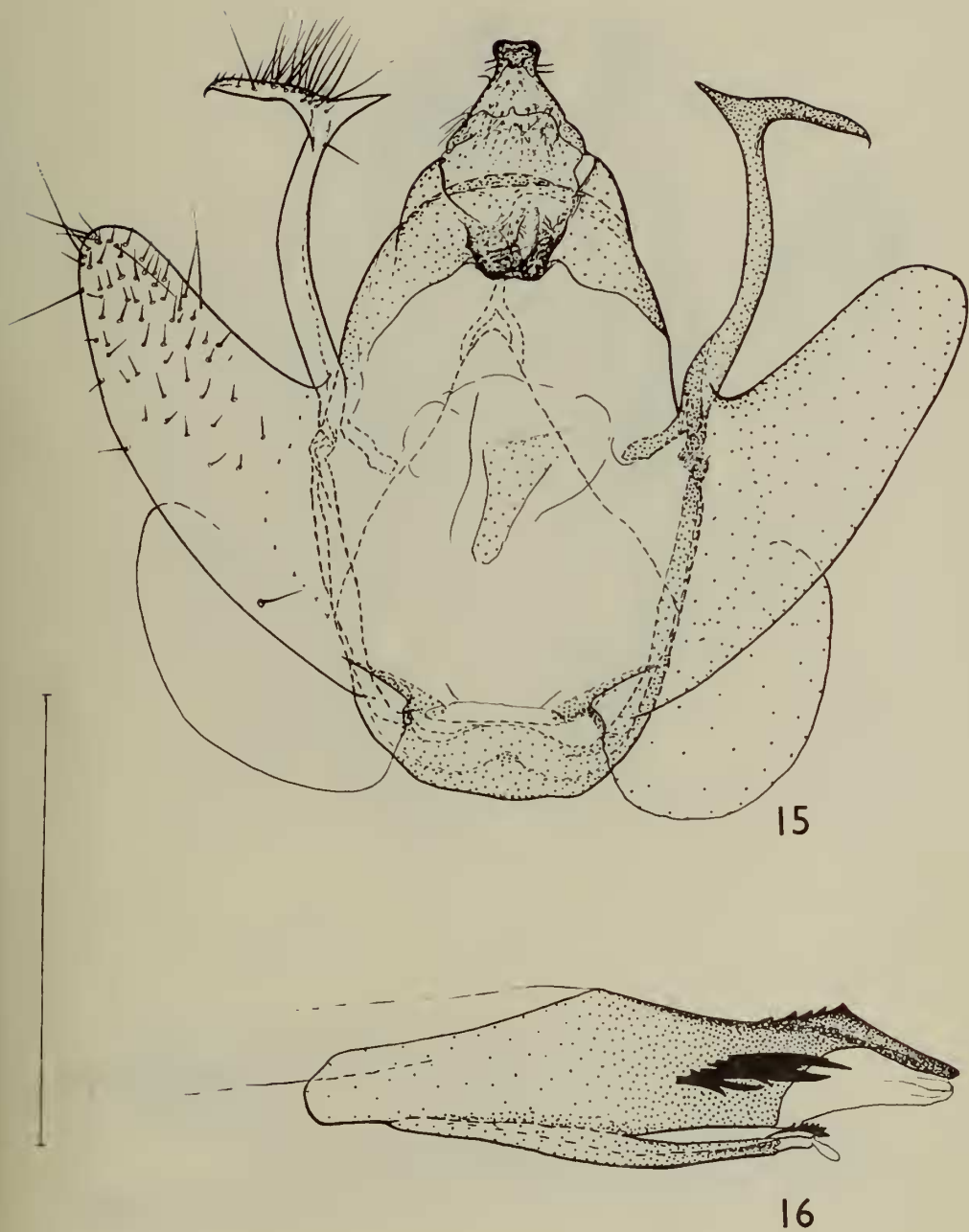
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FIGS 11, 12. *Zamarada inermis*, genitalia (A.S.). 11, ♂; 12, aedeagus.

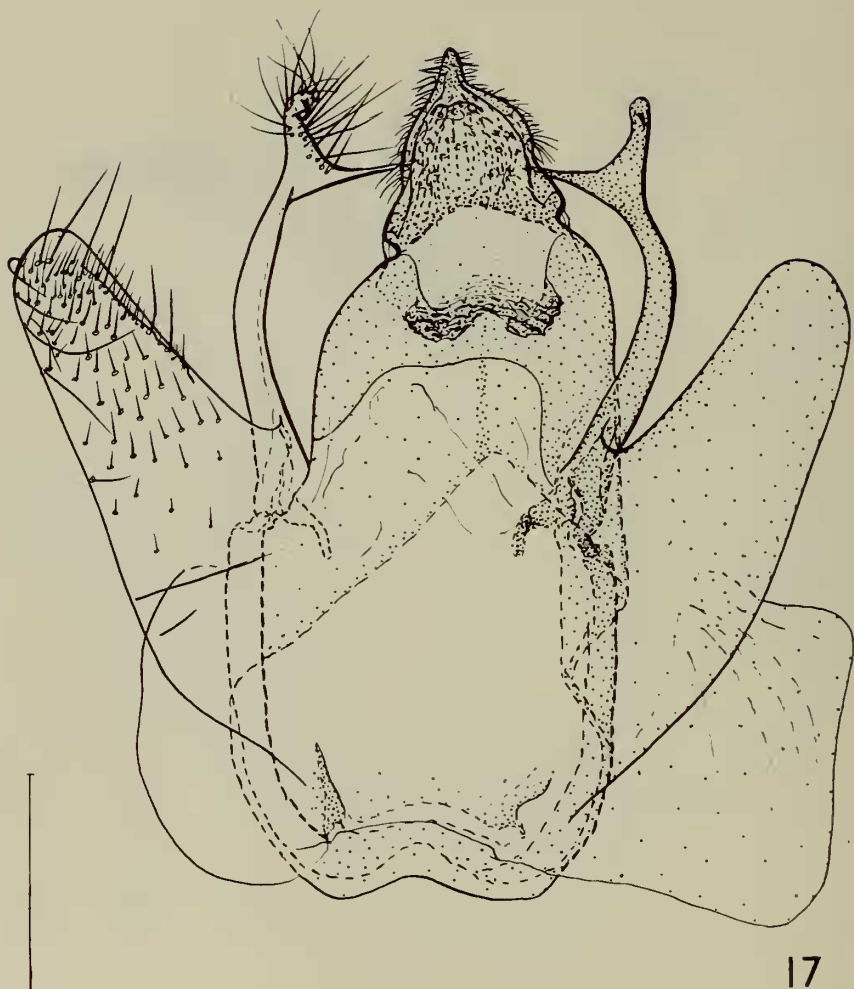




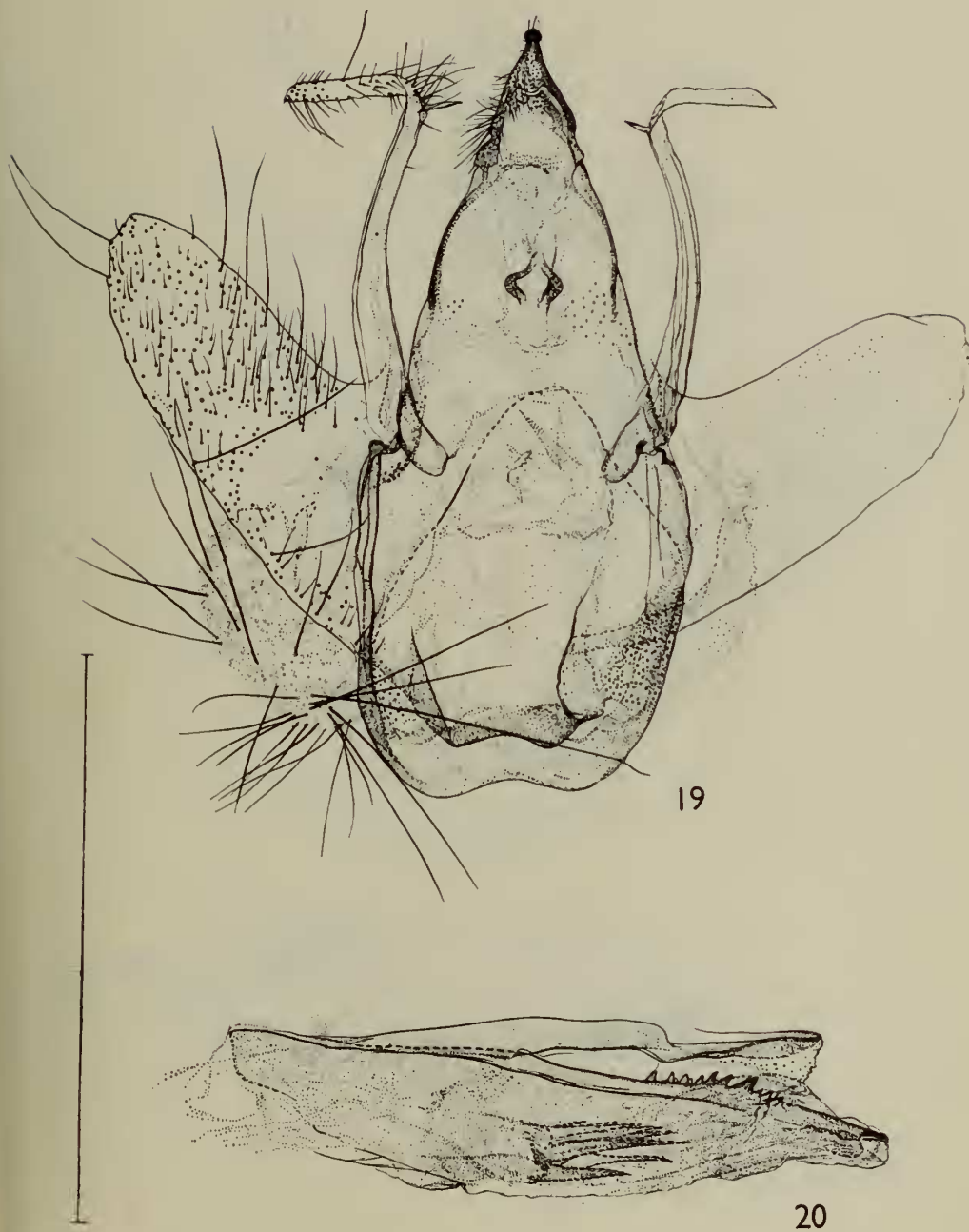
FIGS 13, 14. *Zamarada ansorgei*, genitalia (A.S.). 13, ♂; 14, aedeagus.



FIGS 15, 16. *Zamarada minimaria*, genitalia (J.A.). 15, ♂; 16, aedeagus.

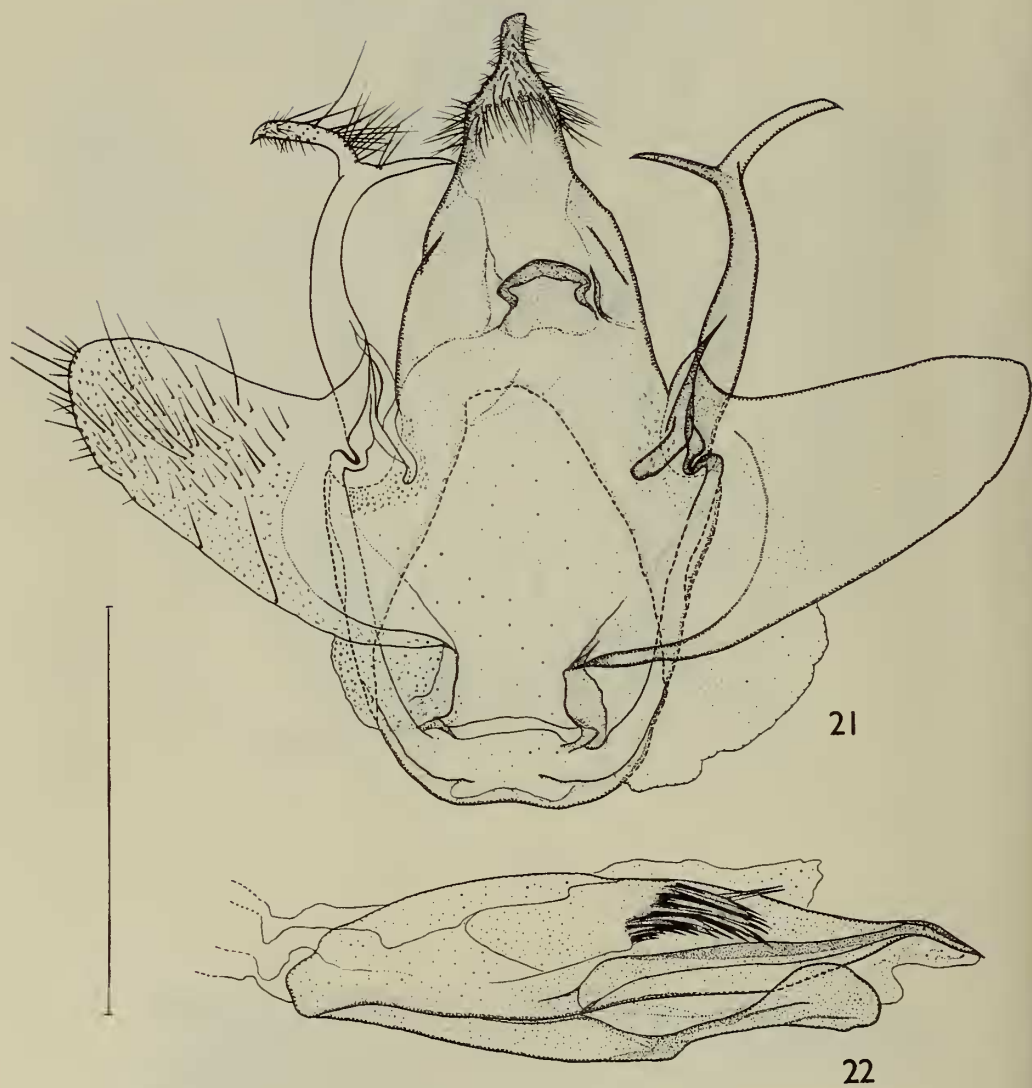


FIGS 17, 18. *Zamarada latilimbata*, genitalia (J.A.). 17, ♂; 18, aedeagus.

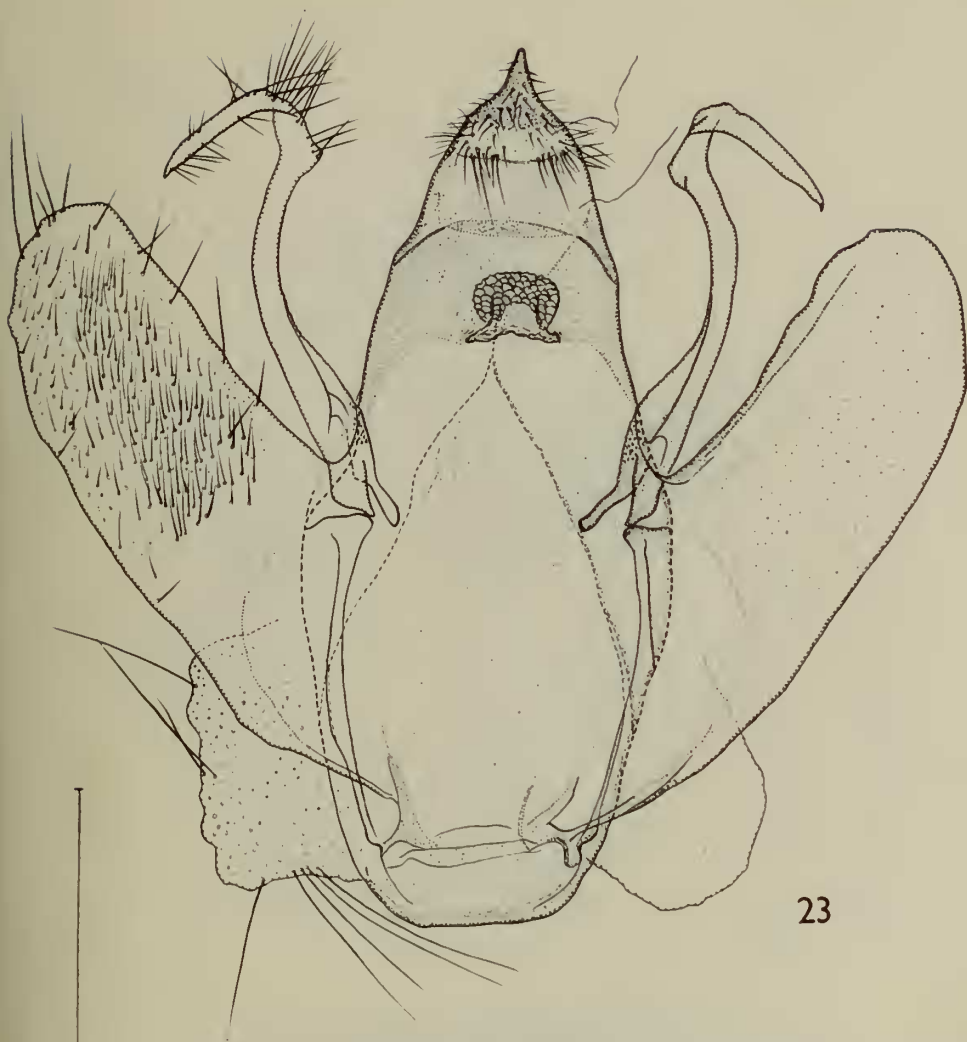


FIGS 19, 20. *Zamarada townsendi*, genitalia (A.P.). 19, ♂; 20, aedeagus.

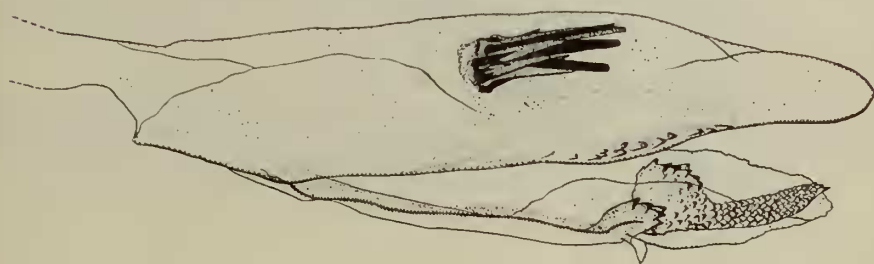




FIGS 21, 22. *Zamarada eurygnathus*, genitalia (M.L.). 21, ♂; 22, aedeagus.

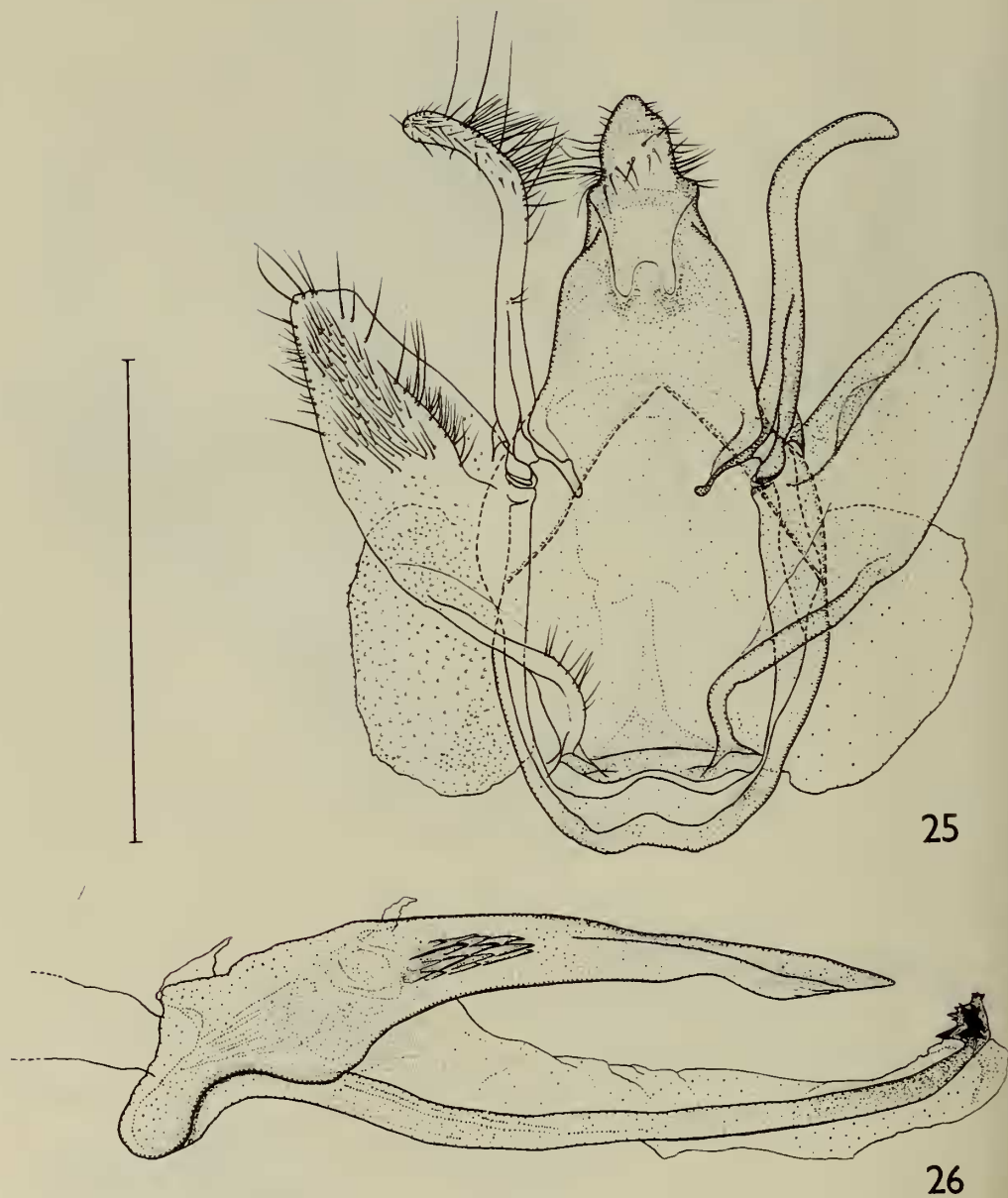


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FIGS 23, 24. *Zamarada anacantha*, genitalia (M.L.). 23, ♂; 24, aedeagus.



FIGS 25, 26. *Zamarada aureomarginata*, genitalia (M.L.). 25, ♂; 26, aedeagus.



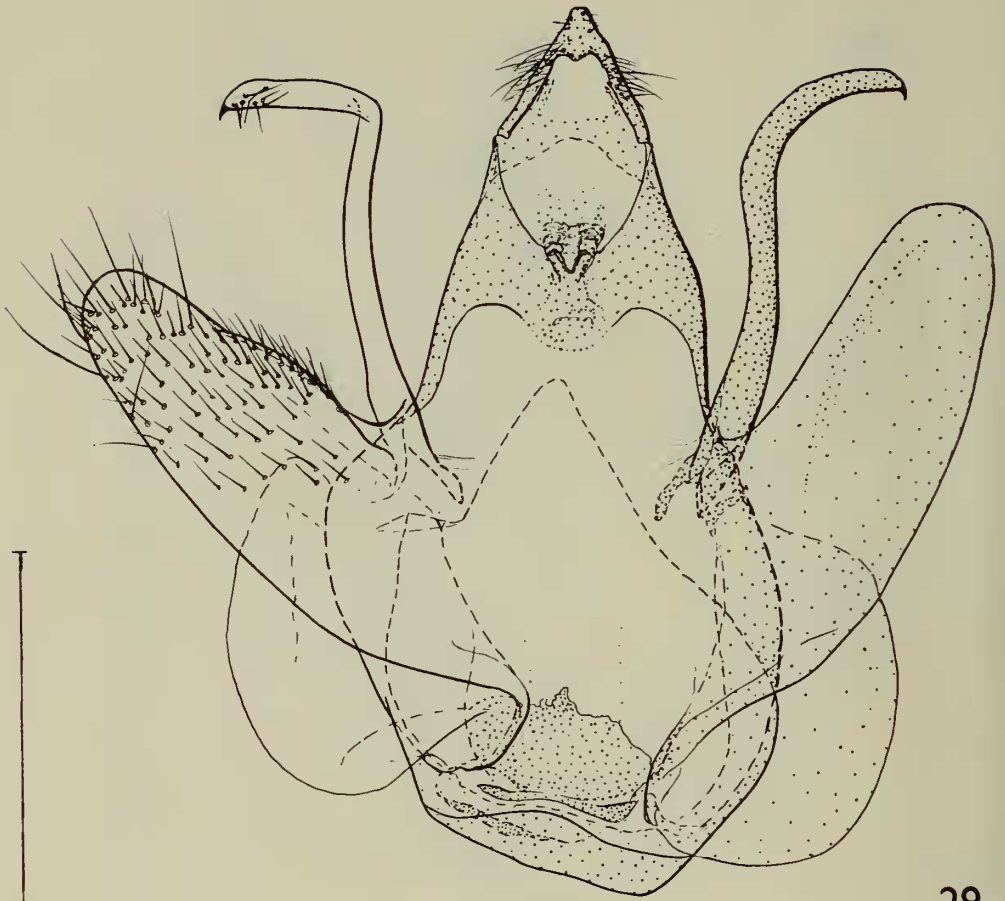
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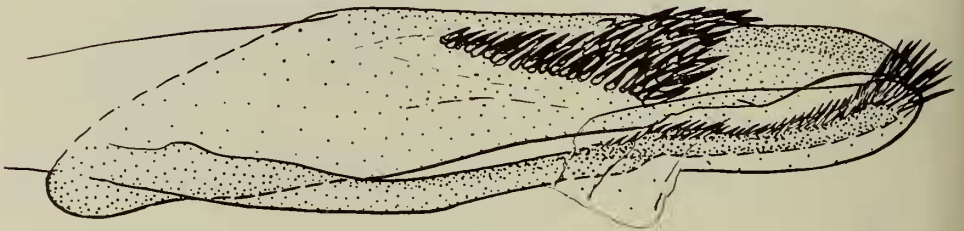
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FIGS 27, 28. *Zamarada griveaudi*, genitalia (M.L.). 27, ♂; 28, aedeagus.



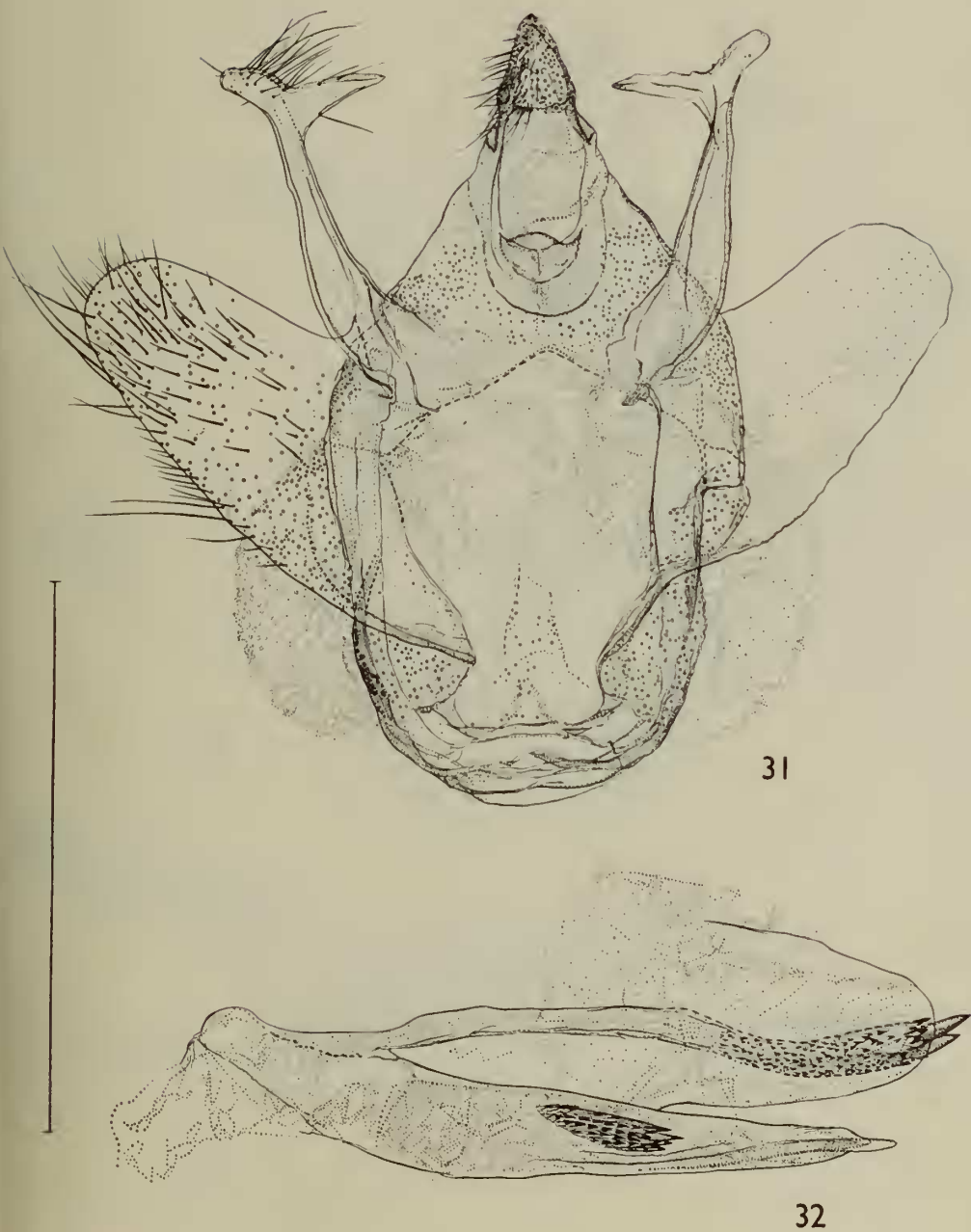


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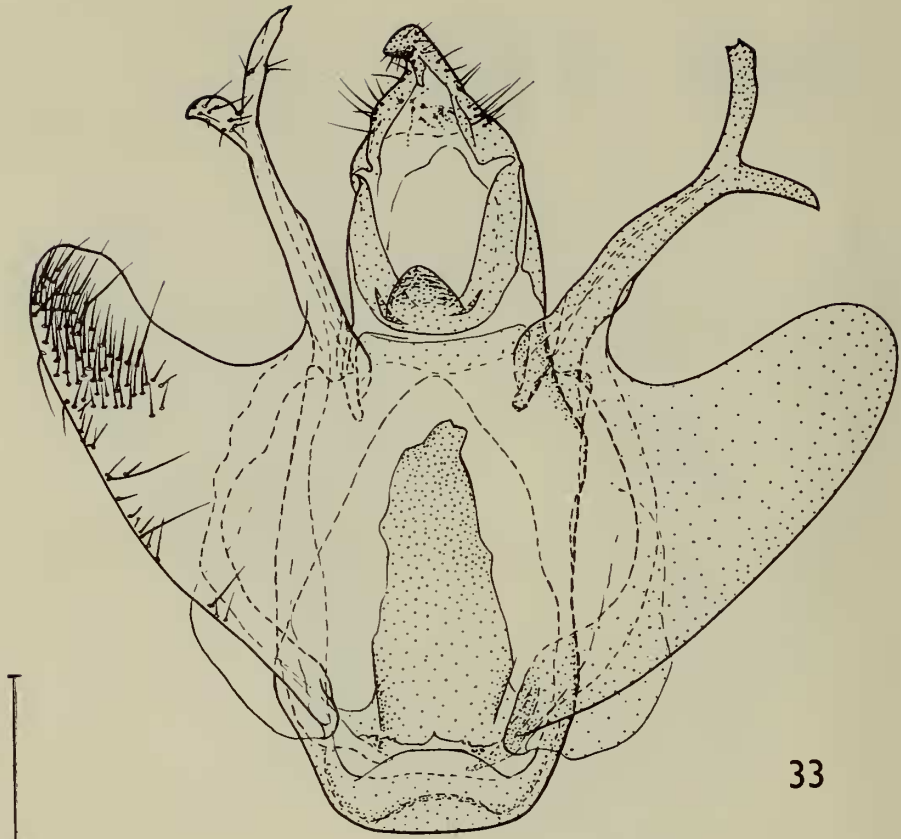


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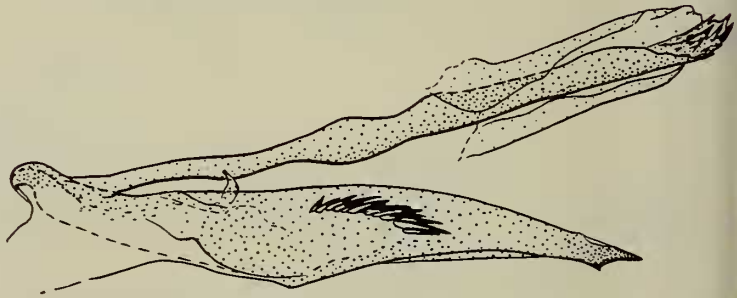
FIGS 29, 30. *Zamarada phaeozona*, genitalia (J.A.). 29, ♂; 30, aedeagus.



FIGS 31, 32. *Zamarada labrys*, genitalia (A.P.). 31, ♂; 32, aedeagus.

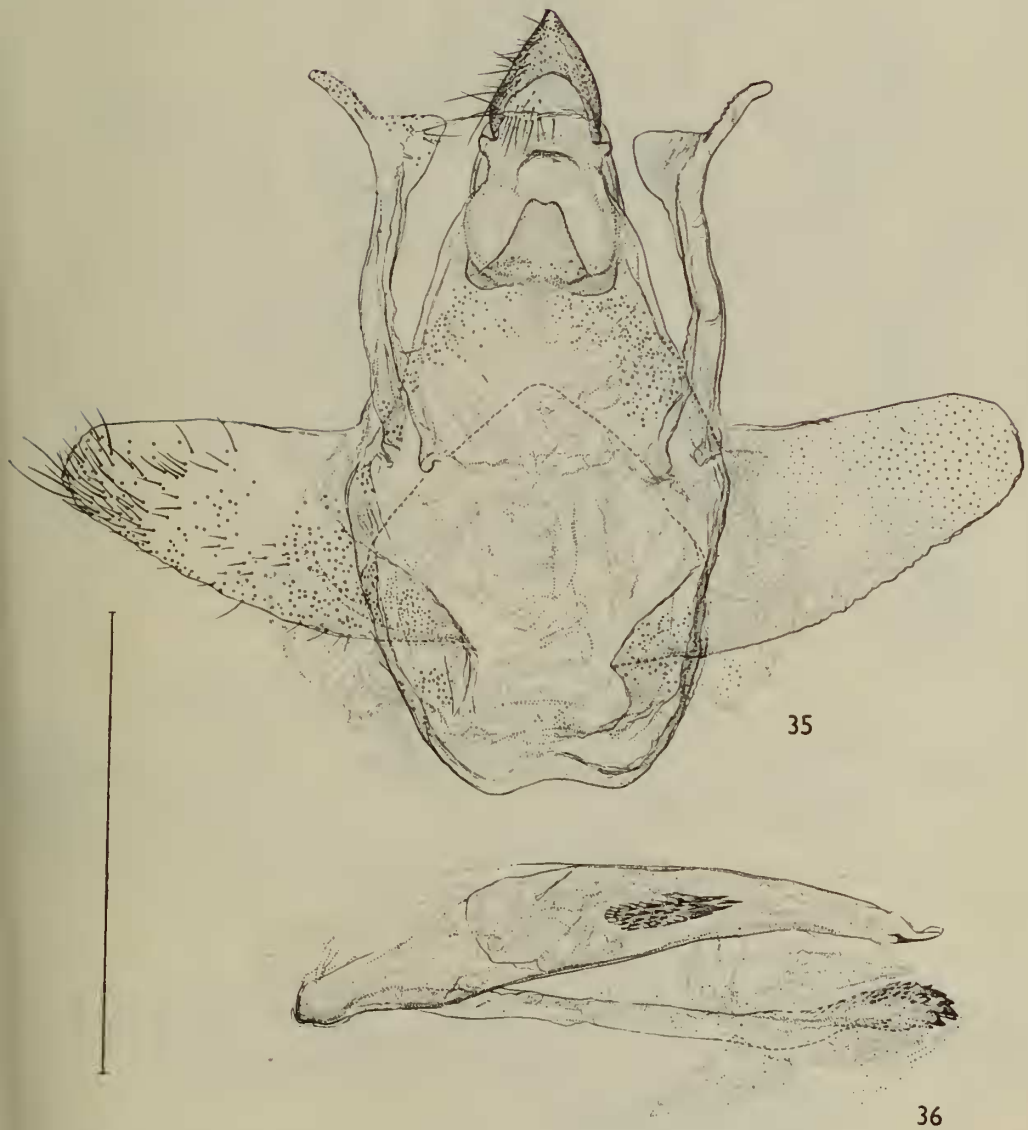


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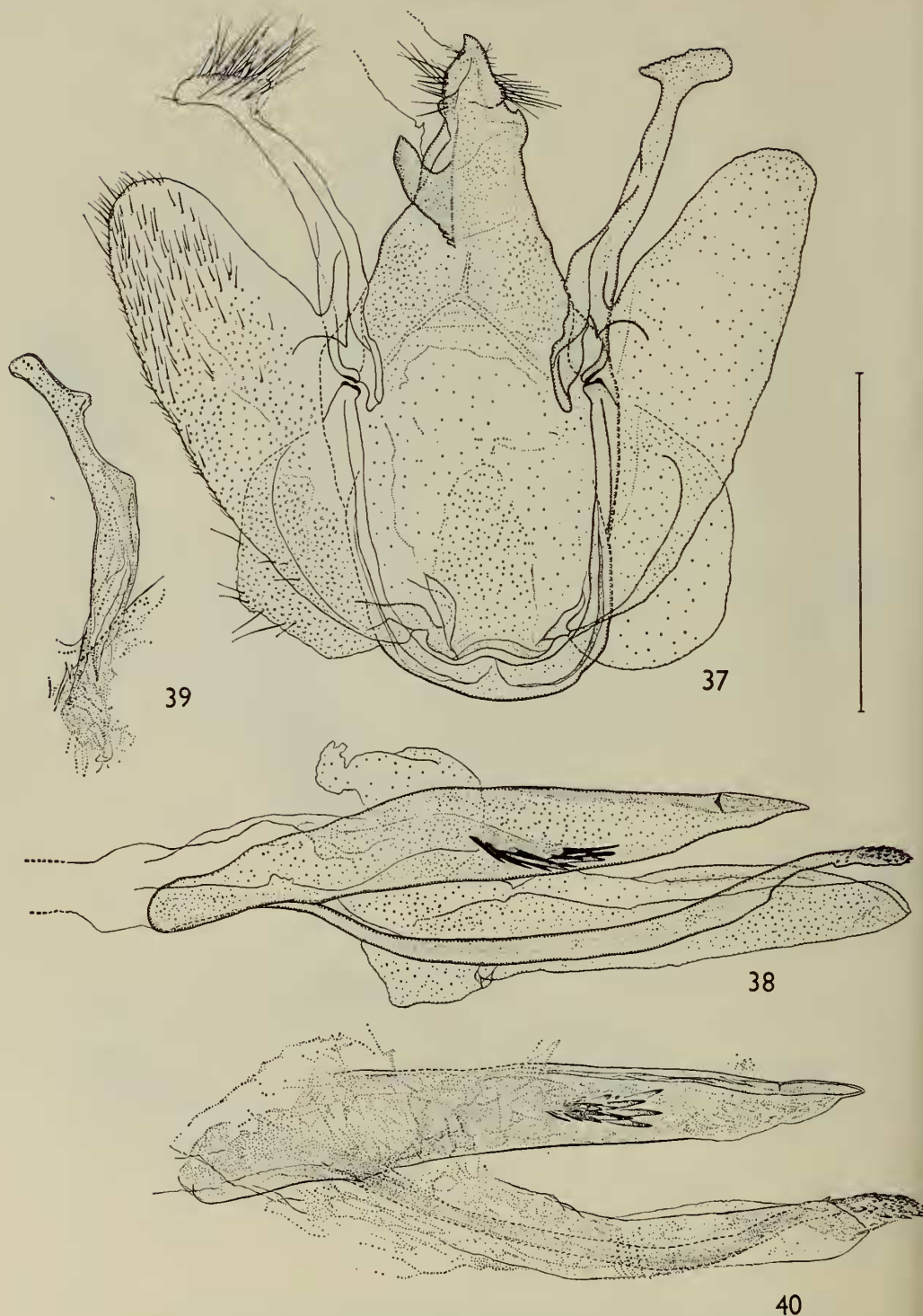
34

FIGS 33, 34. *Zamarada mesotaenia*, genitalia (J.A.). 33, ♂; 34, aedeagus.

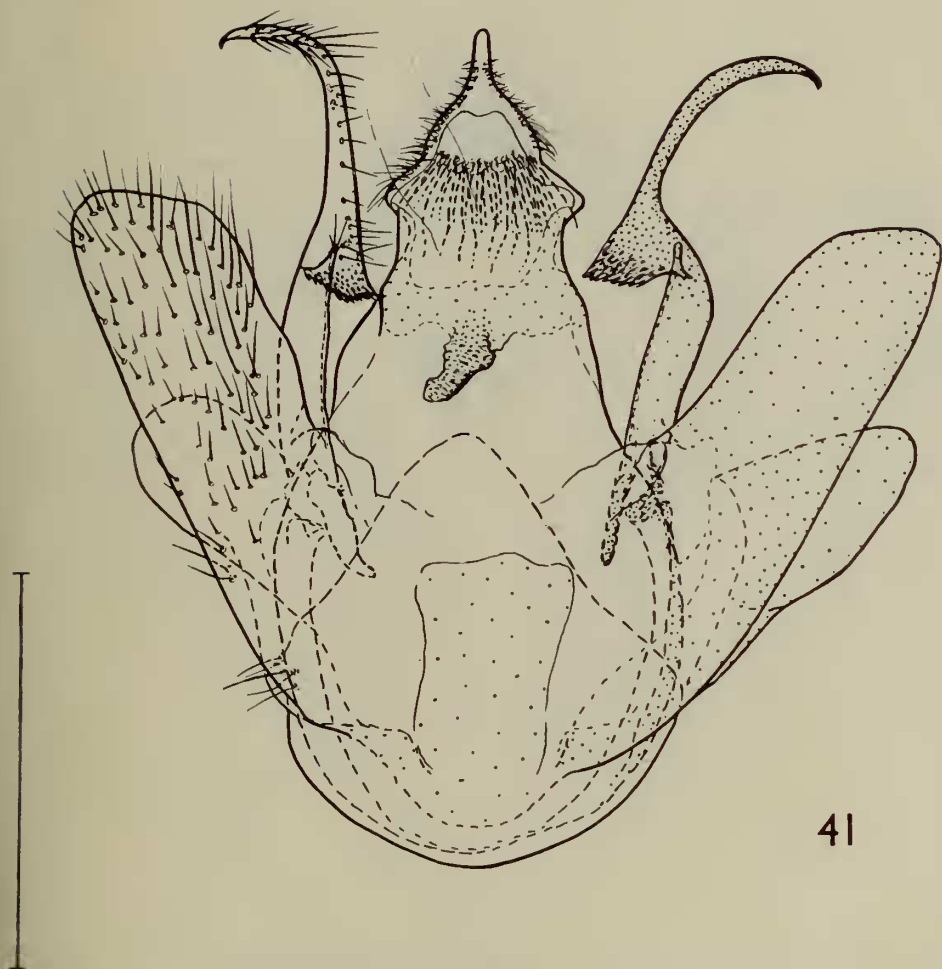


FIGS 35, 36. *Zamarada consecuta*, genitalia (A.P.). 35, ♂; 36, aedeagus.

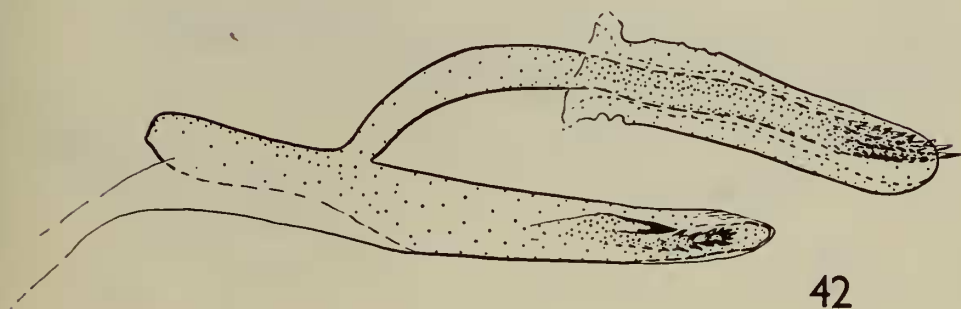




FIGS 37, 38. *Zamarada deceptrix*, genitalia (M.L.). 37, ♂; 38, aedeagus.  
 FIGS 39, 40. *Zamarada delosis*, genitalia (A.P.). 39, dorsal process of left valve; 40, aedeagus.

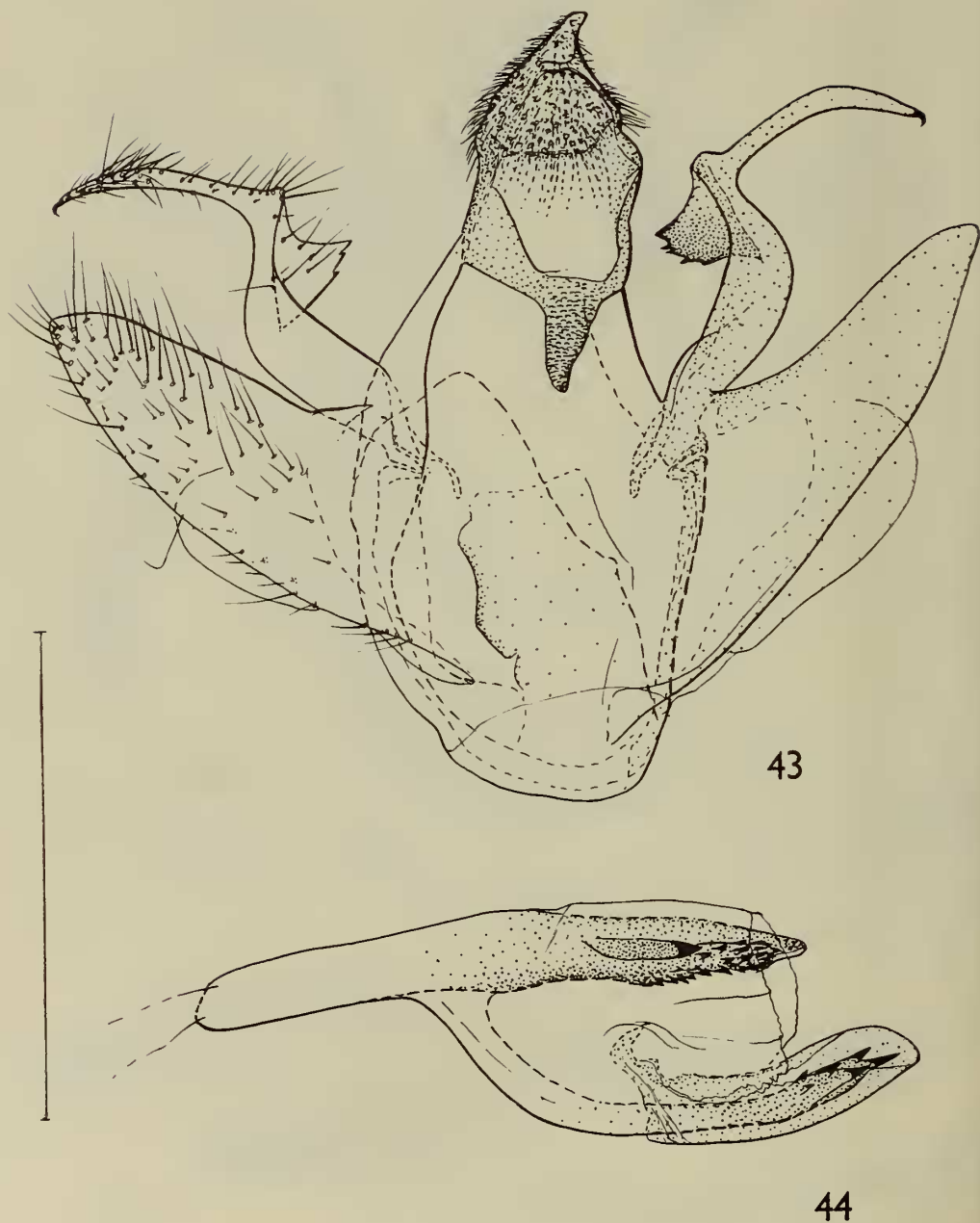


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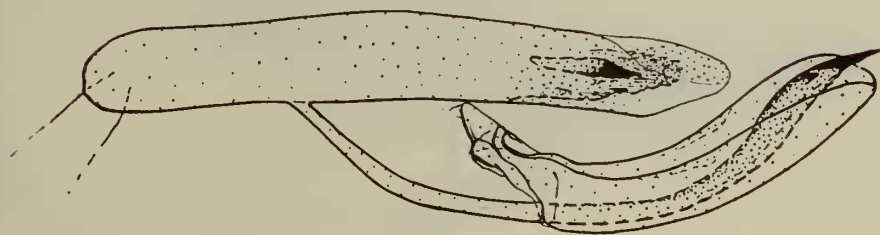


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FIGS 41, 42. *Zamarada chrysothyra*, genitalia (J.A.). 41, ♂; 42, aedeagus.



FIGS 43, 44. *Zamarada amicta*, genitalia (J.A.). 43, ♂; 44, aedeagus.

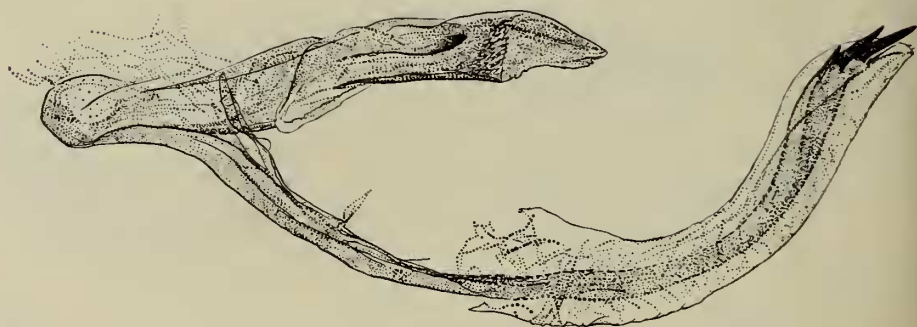


FIGS 45, 46. *Zamarada ordinaria*, genitalia (J.A.). 45, ♂; 46, aedeagus.





47

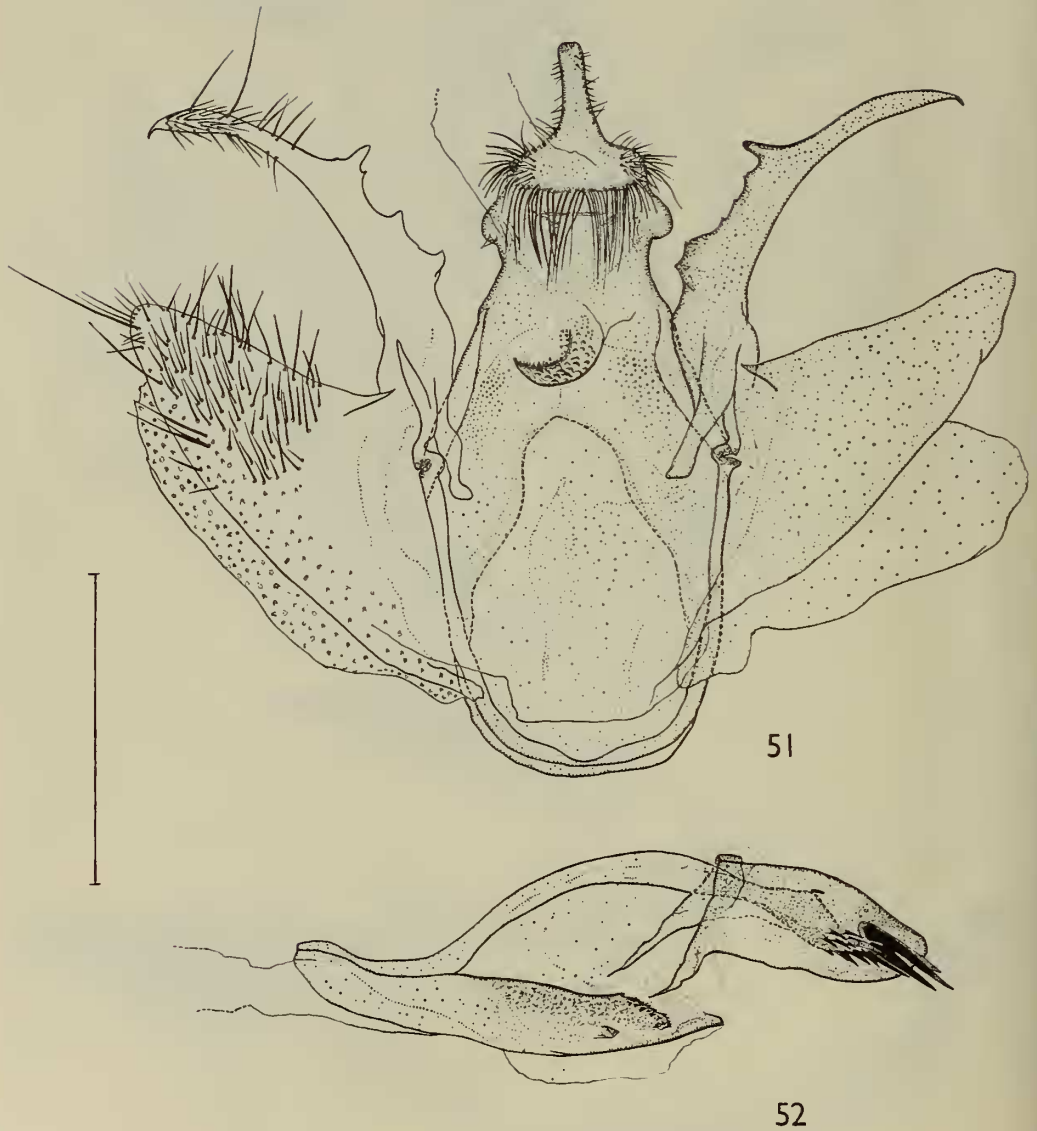


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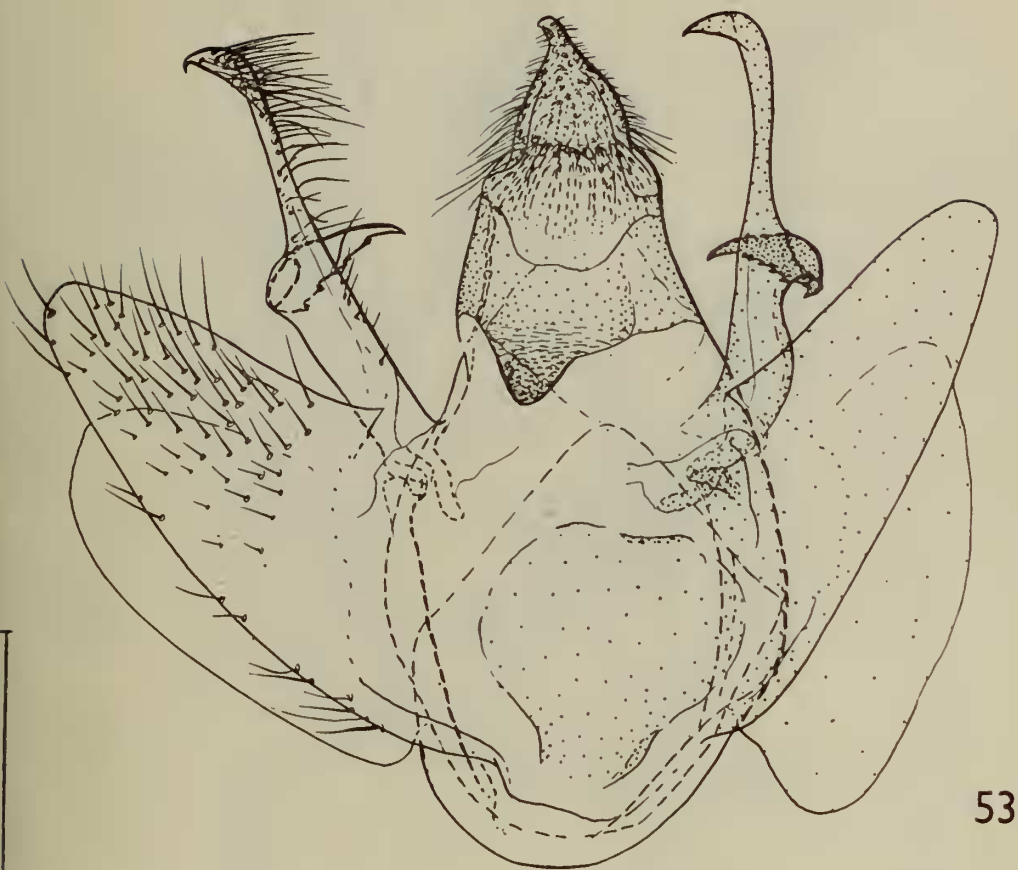
FIGS 47, 48. *Zamarada metallicata*, genitalia (A.P.). 47, ♂; 48, aedeagus.



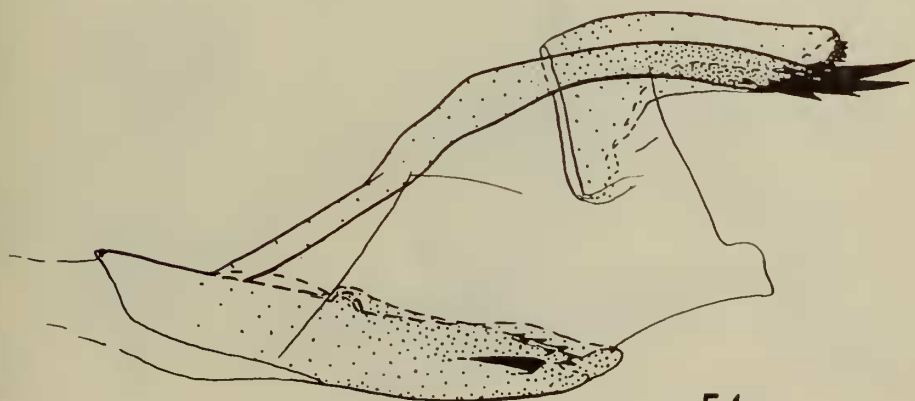
FIGS 49, 50. *Zamarada erugata*, genitalia. 49, ♂ (S.S.); 50, aedeagus (A.P.).



FIGS 51, 52. *Zamarada prionotos*, genitalia (M.L.). 51, ♂; 52, aedeagus.



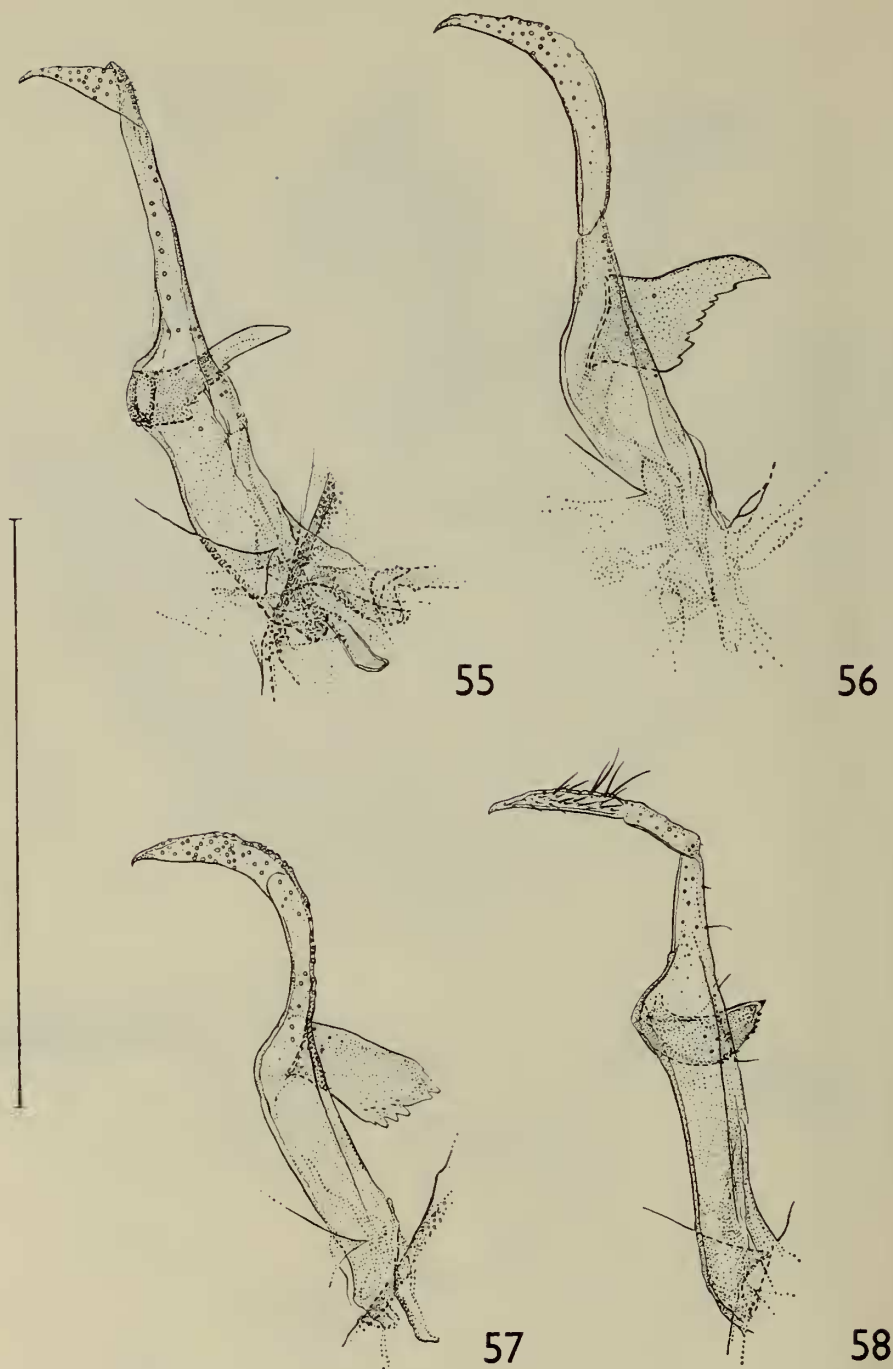
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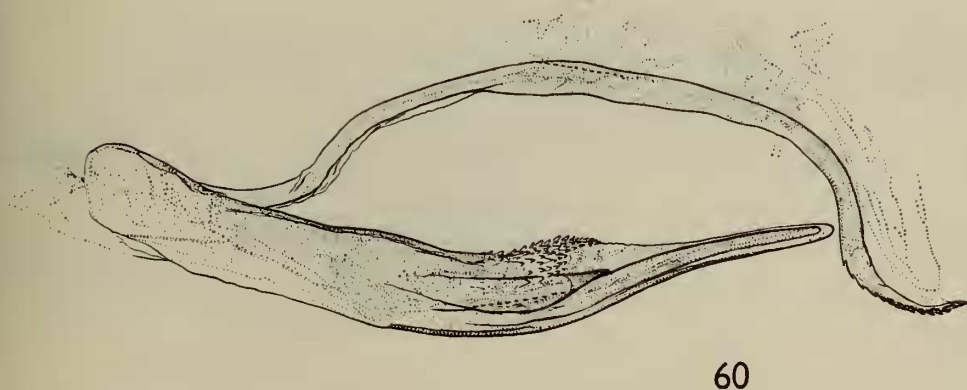
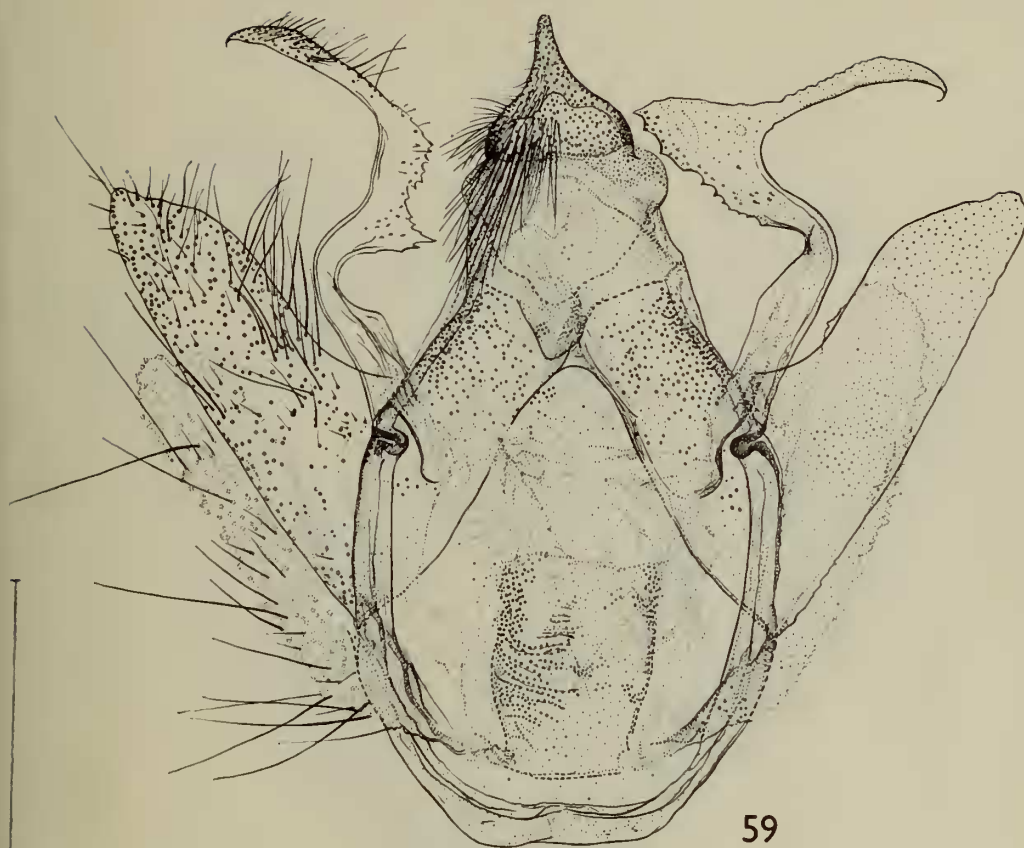
FIGS 53, 54. *Zamarada pulverosa*, genitalia (J.A.). 53, ♂; 54, aedeagus.



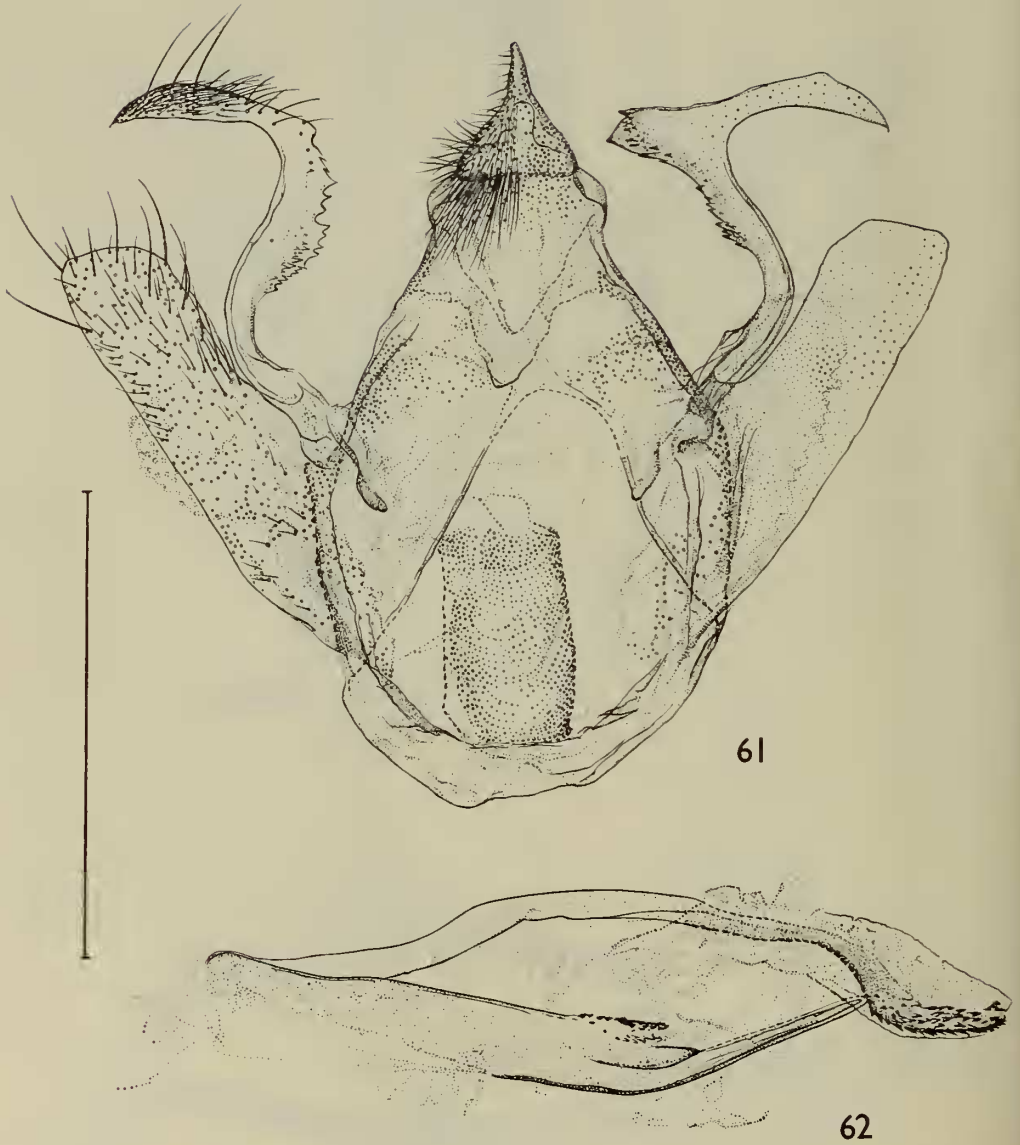


FIGS 55-57. *Zamarada pulverosa*, genitalia (A.P.). 55-57, each a dorsal process of a left valve.

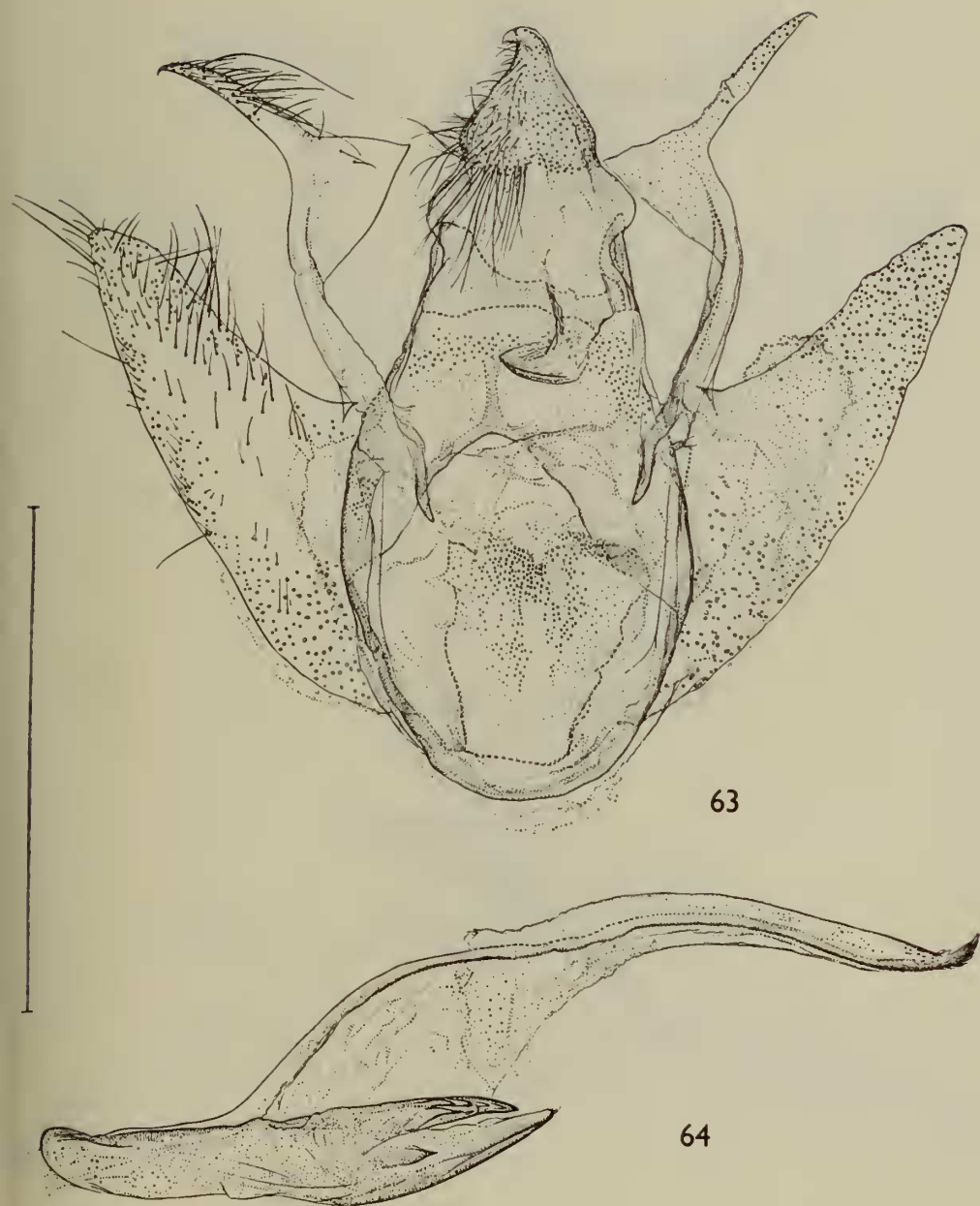
FIG. 58. *Zamarada ascapthes*, genitalia (A.P.). 58, dorsal process of left valve.



FIGS 59, 60. *Zamarada torrida*, genitalia (A.P.). 59, ♂; 60, aedeagus.

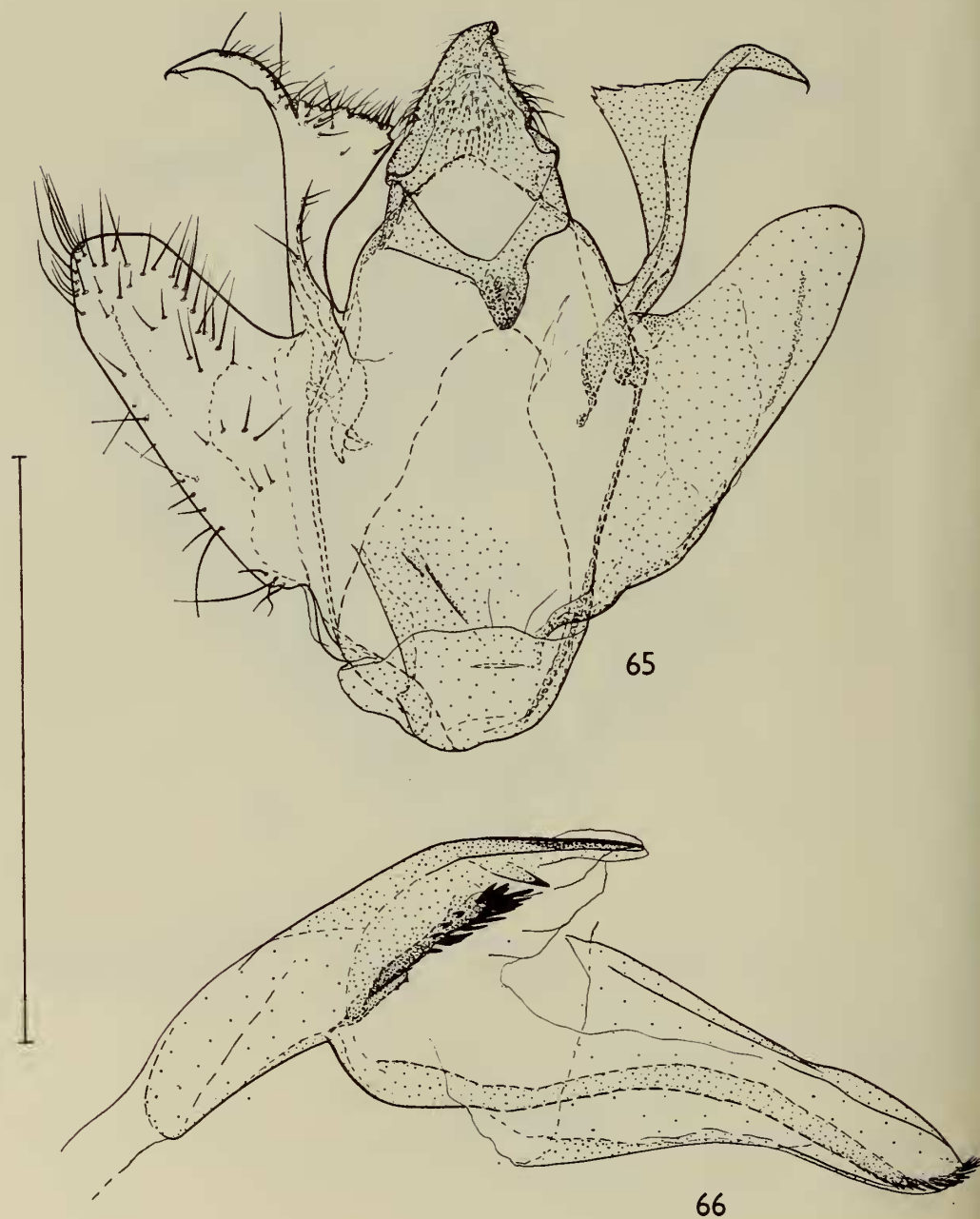


FIGS 61, 62. *Zamarada tosta*, genitalia (A.P.). 61, ♂; 62, aedeagus.

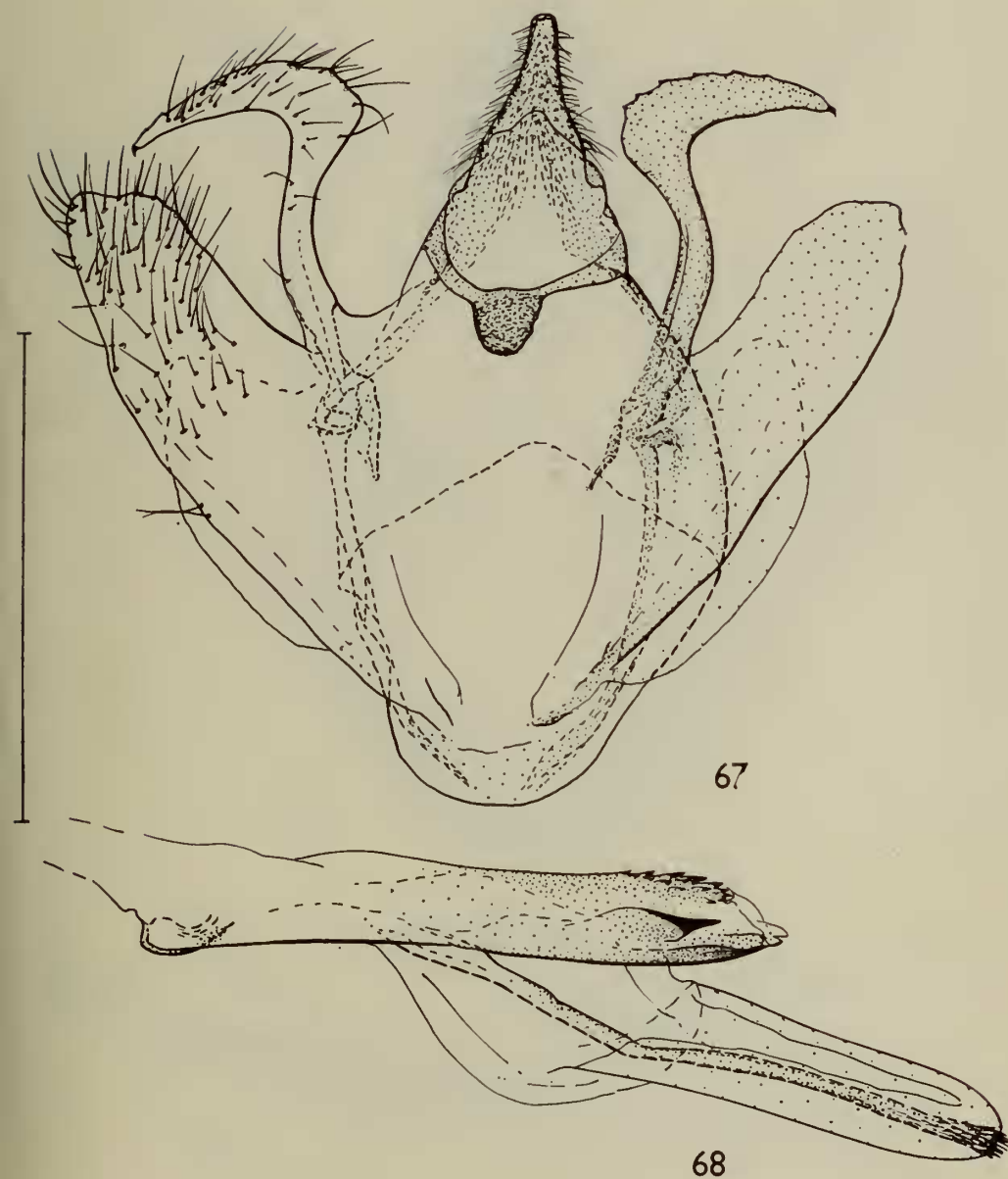


FIGS 63, 64. *Zamarada delta*, genitalia (A.P.). 63, ♂; 64, aedeagus.





FIGS 65, 66. *Zamarada psammites*, genitalia (J.A.). 65, ♂; 66, aedeagus.



FIGS 67, 68. *Zamarada hyalinaria*, genitalia (J. A.). 67, ♂; 68, aedeagus.

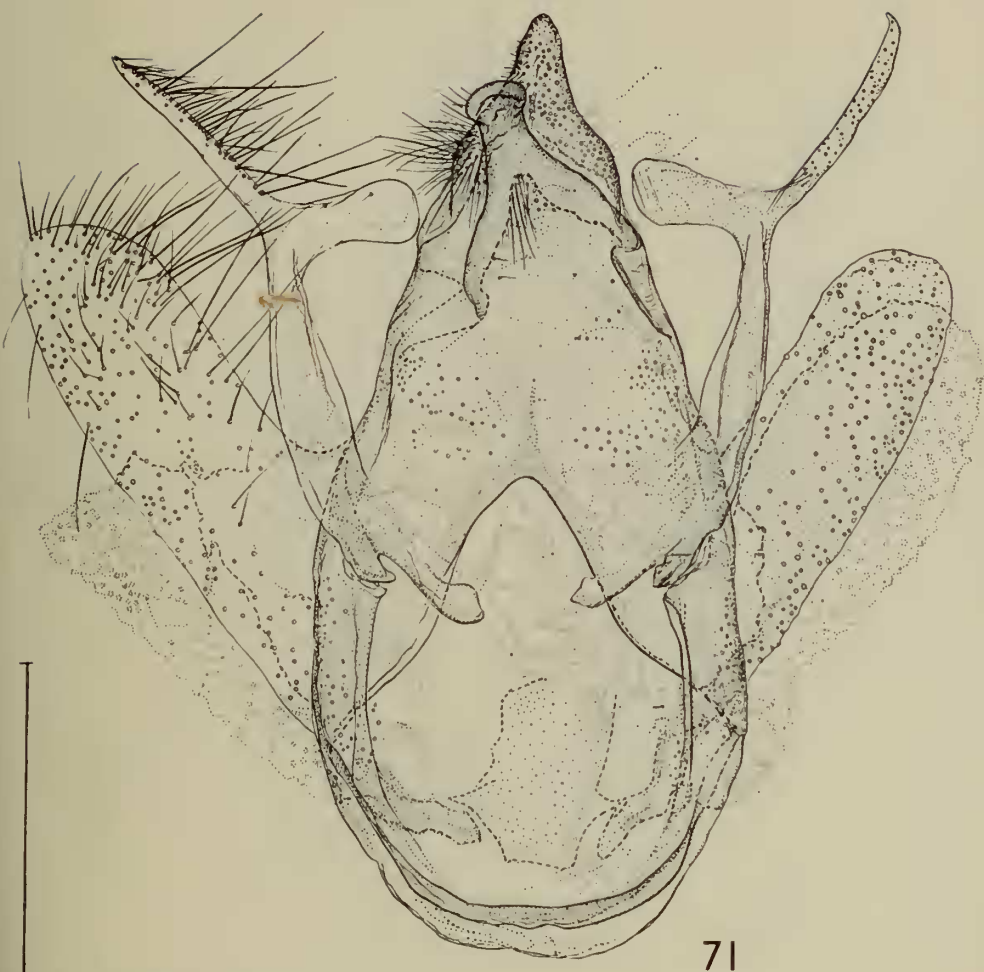


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70

FIGS 69, 70. *Zamarada ochrata*, genitalia (M.L.). 69, ♂; 70, aedeagus.



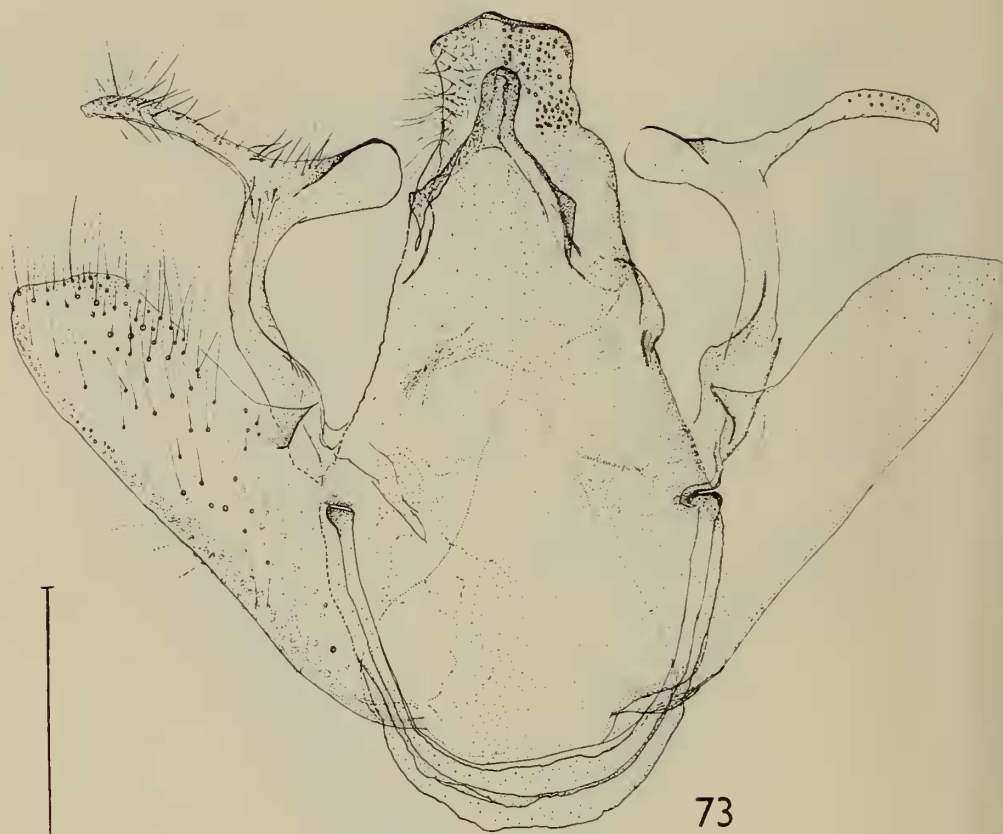
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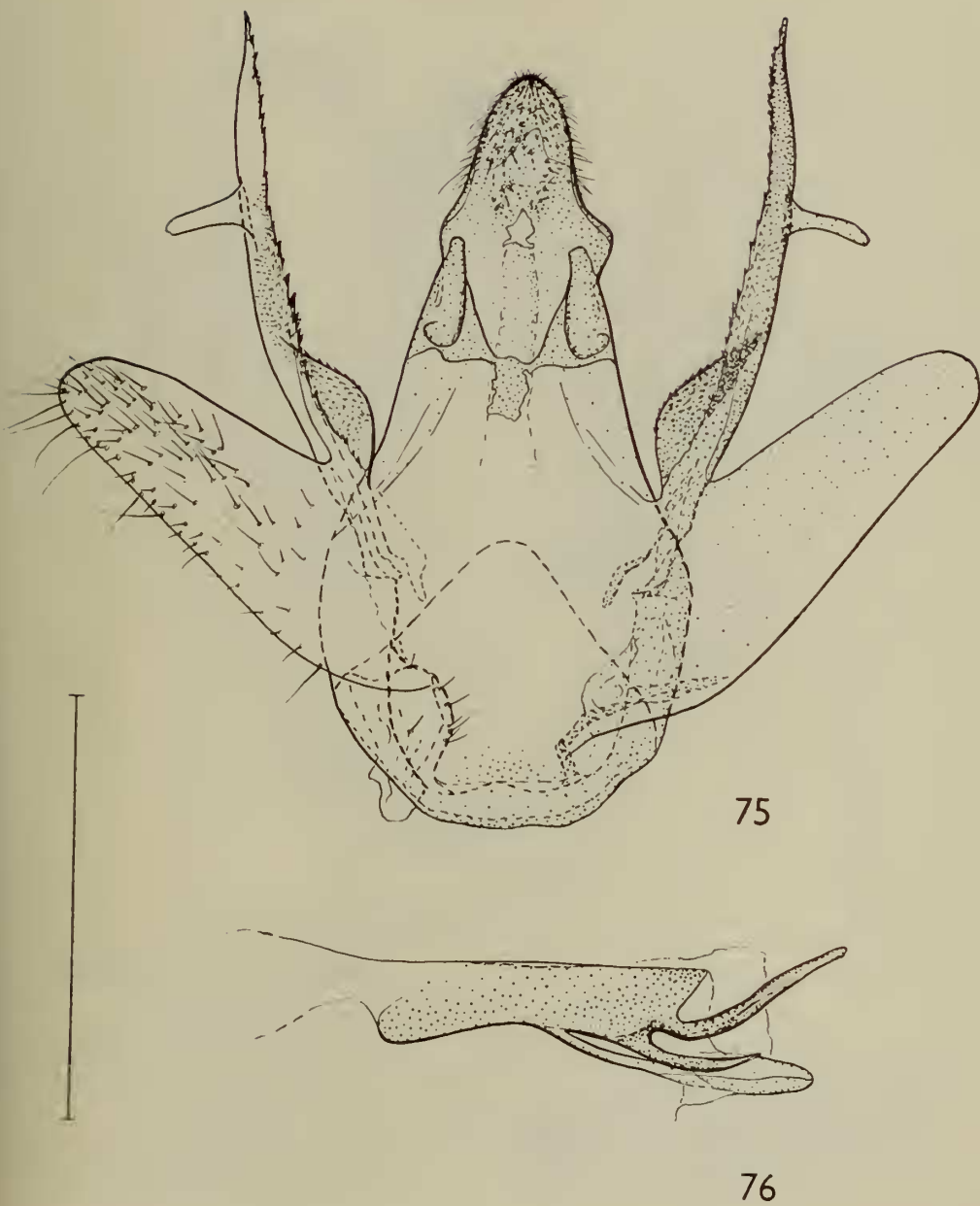
72

FIGS 71, 72. *Zamarada melasma*, genitalia (A.P.). 71, ♂; 72, aedeagus.

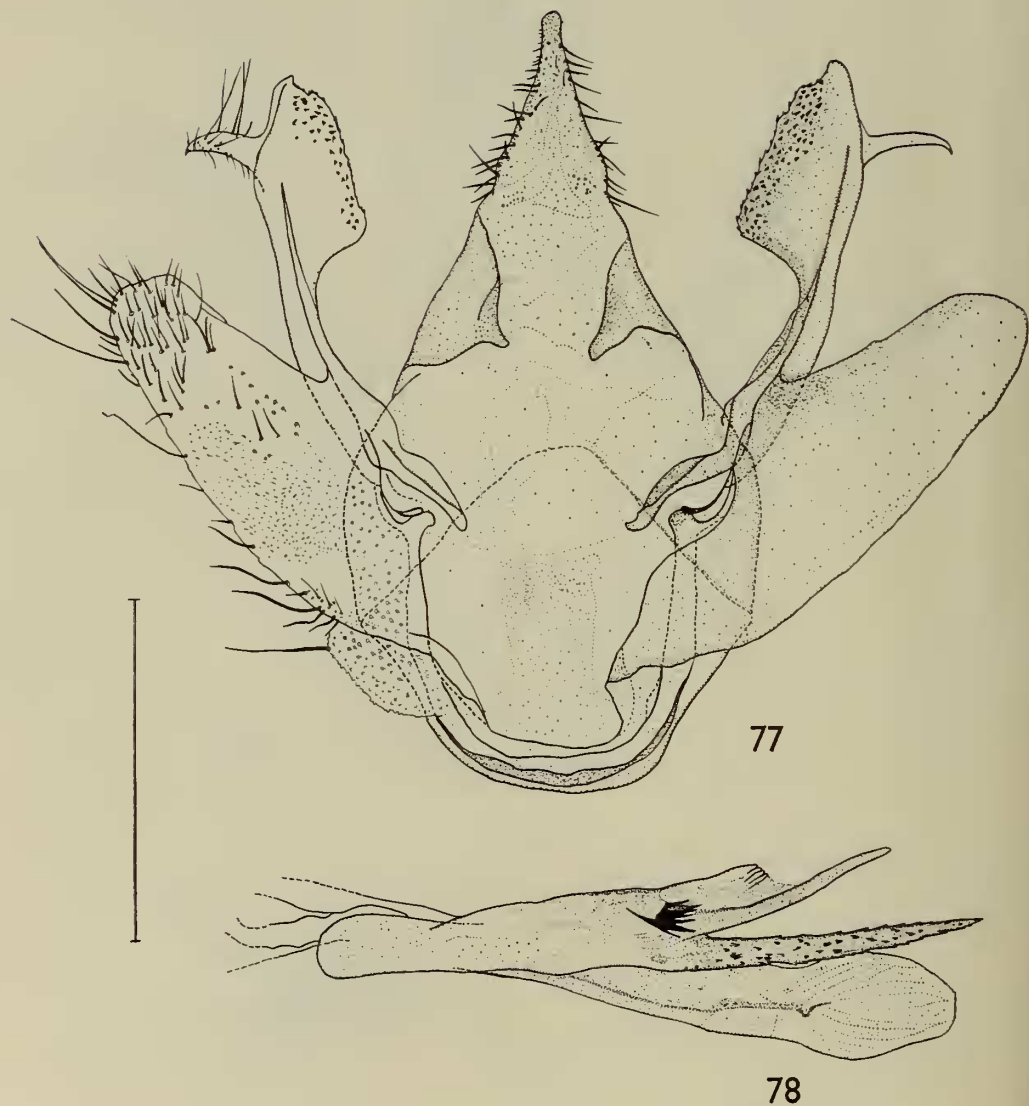




FIGS 73, 74. *Zaramada ilma*, genitalia (S.S.). 73, ♂; 74, aedeagus.



FIGS 75, 76. *Zamarada differens*, genitalia (J.A.). 75, ♂; 76, aedeagus.



FIGS 77, 78. *Zamarada jansei*, genitalia (M.L.). 77, ♂; 78, aedeagus.

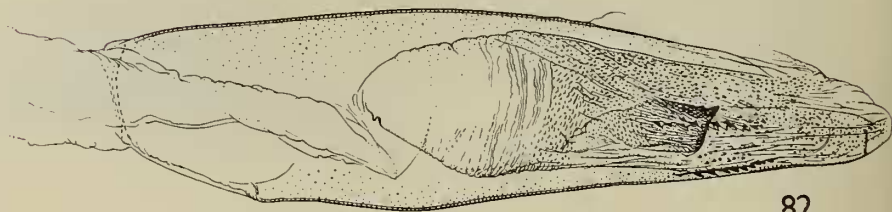


FIGS 79, 80. *Zamarada scriptifasciata*, genitalia (A.S.). 79, ♂; 80 aedeagus.





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82

FIGS 81, 82. *Zamarada baliata*, genitalia, Java (A.S.). 81, ♂; 82, aedeagus.

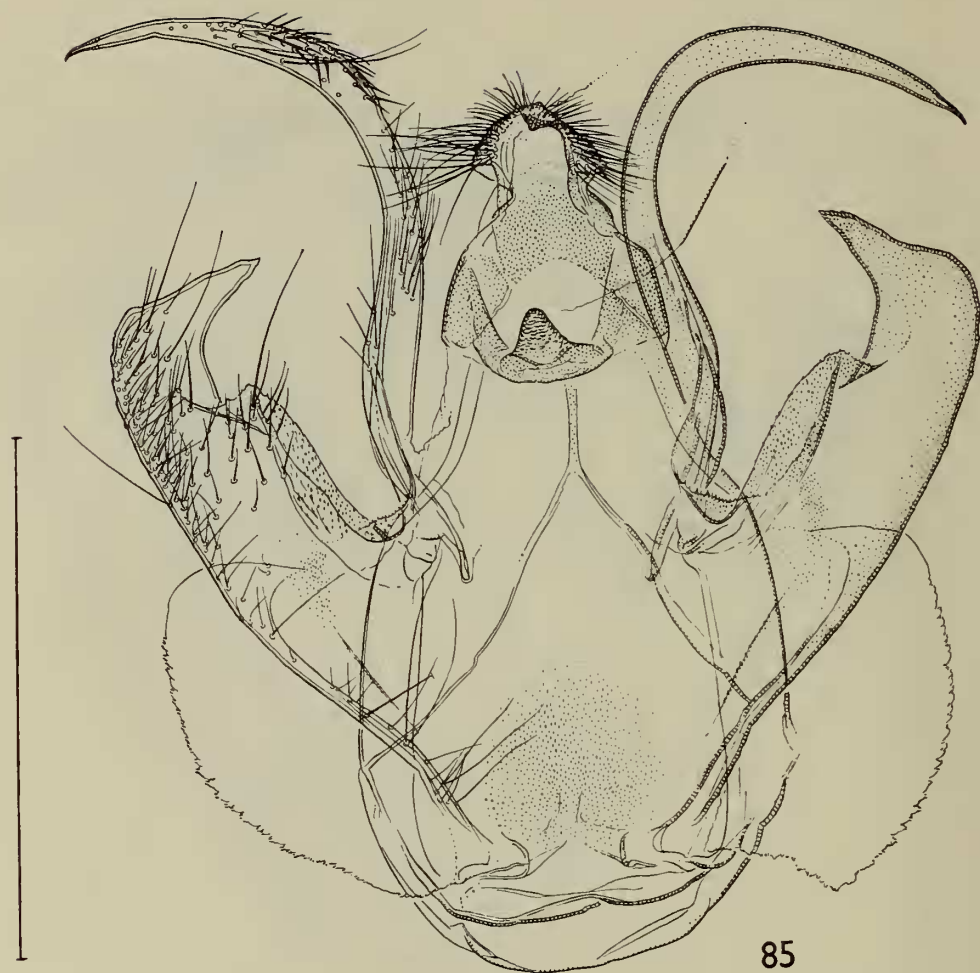


83

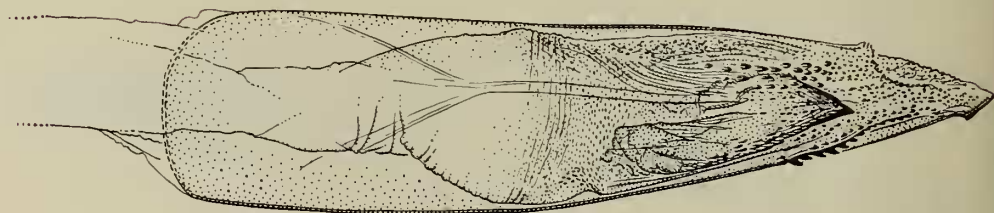


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FIGS 83, 84. *Zamarada baliata*, genitalia, Sumatra (A.S.). 83, ♂; 84, aedeagus.



85

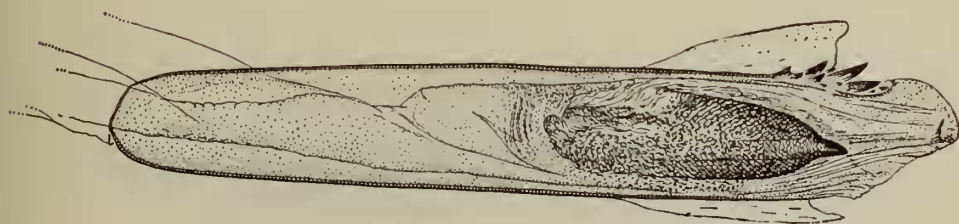


86

FIGS 85, 86. *Zamarada symmetra*, genitalia (A.S.). 85, ♂; 86, aedeagus.



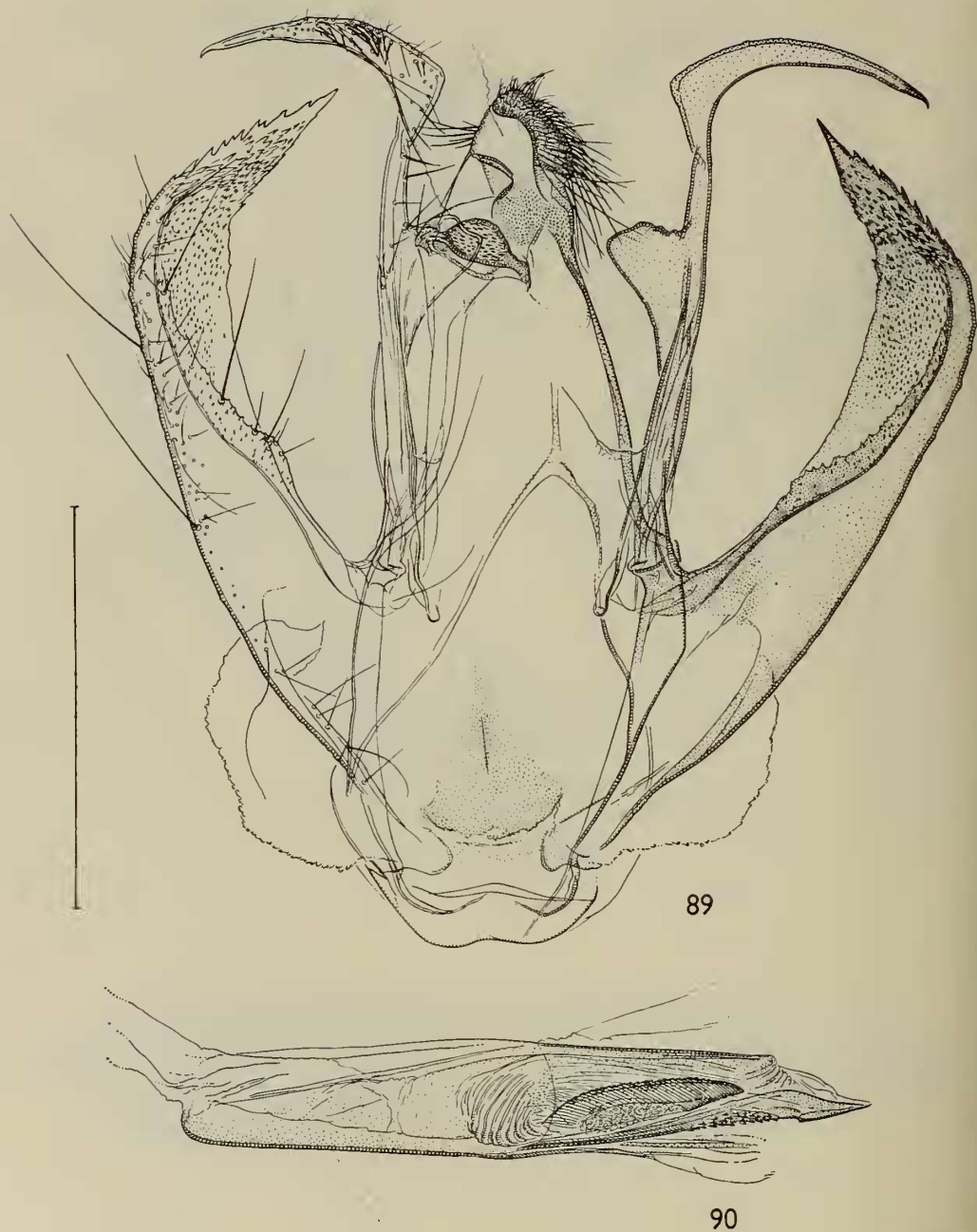
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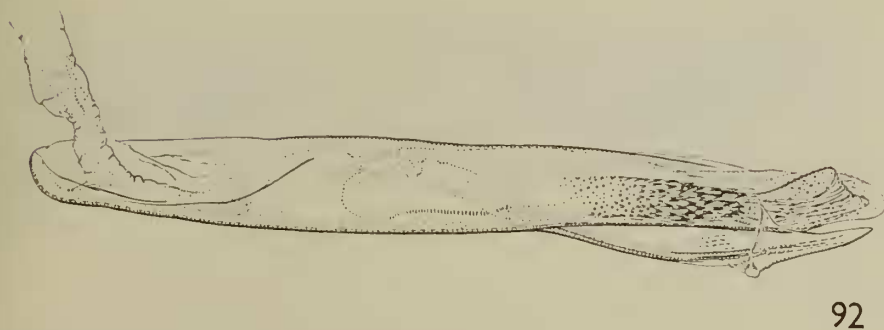
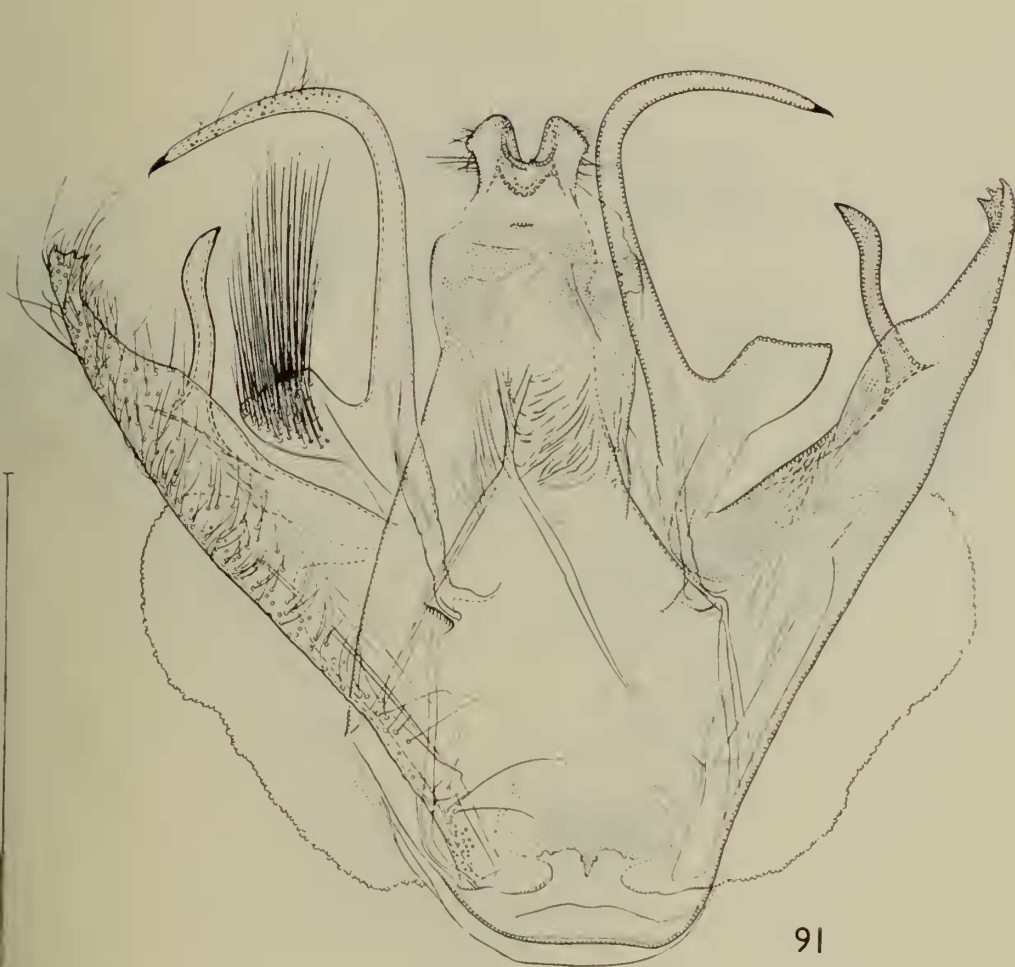
88

FIGS 87, 88. *Zamarada excisa*, genitalia (A.S.). 87, ♂ 88, aedeagus.





FIGS 89, 90. *Zamavada denticulata*, genitalia (A.S.). 89, ♂; 90, aedeagus.



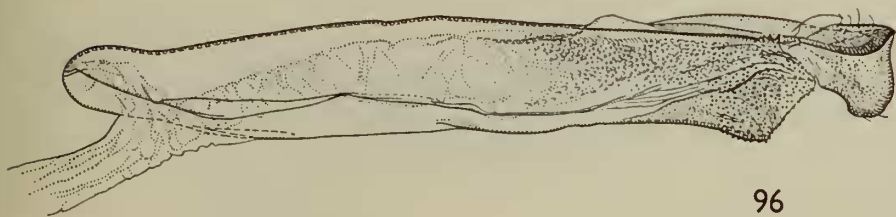
FIGS 91, 92. *Zamarada eogenaria eogenaria*, genitalia (A.S.). 91, ♂; 92, aedeagus



FIGS 93, 94. *Zamarada eogenaria cosmiaria*, genitalia (A.S.). 93, ♂; 94, aedeagus.



95



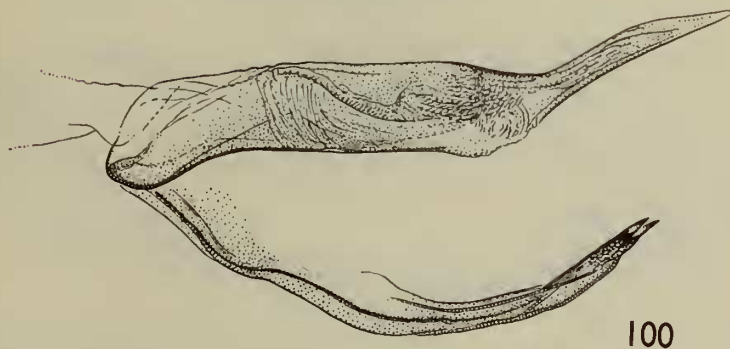
96

FIGS 95, 96. *Zamarada nesiotica*, genitalia (A.S.). 95, ♂; 96, aedeagus.





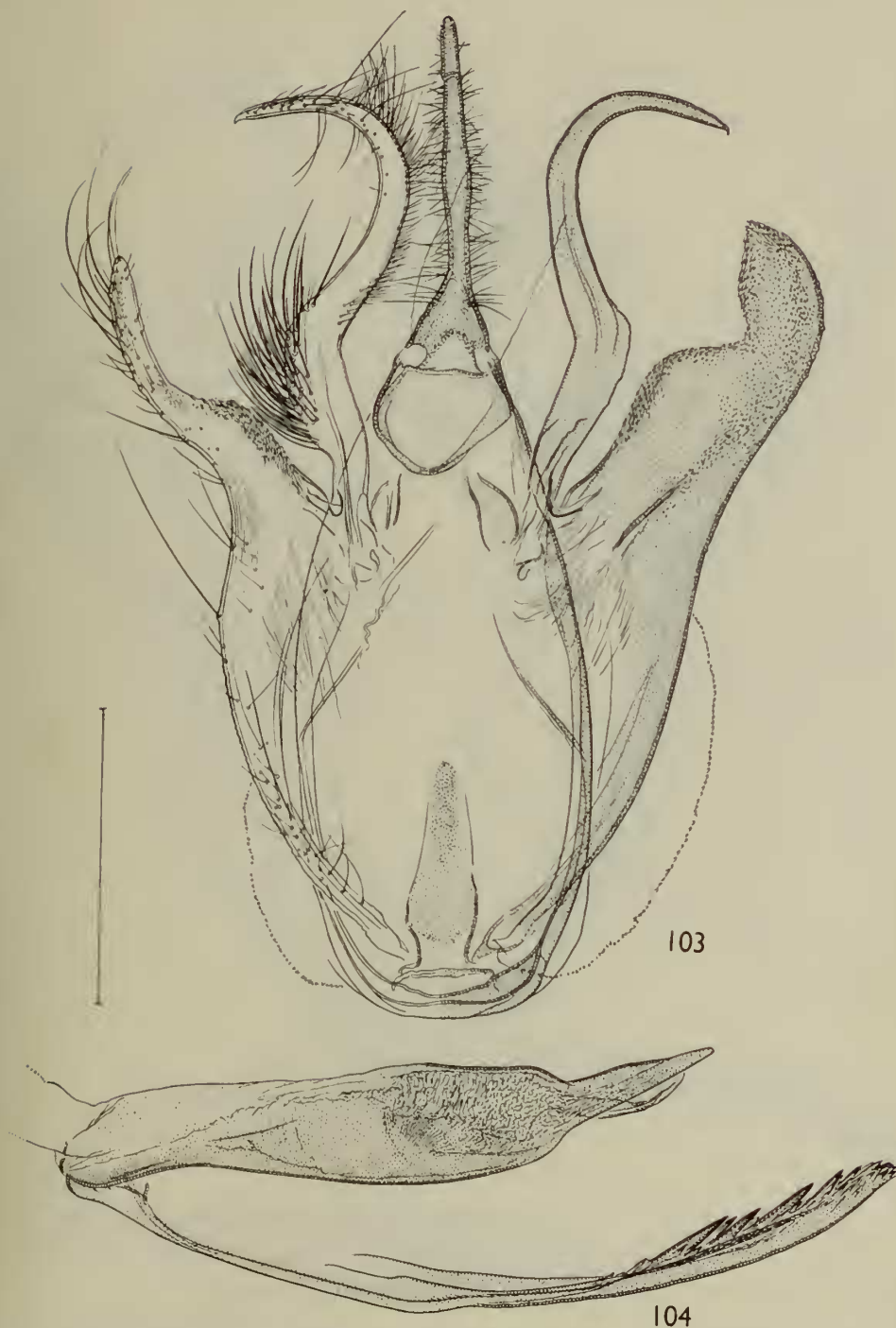
FIGS 97, 98. *Zamarada ucata*, genitalia (A.S.). 97, ♂; 98, aedeagus.



FIGS 99, 100. *Zamarada flavicosta*, genitalia (A.S.). 99, ♂; 100, aedeagus.



FIGS 101, 102. *Zamarada indicata*, genitalia (A.S.). 101, ♂; 102, aedeagus.



FIGS 103, 104. *Zamarada regularis regularis*, genitalia (A.S.). 103, ♂; 104, aedeagus.



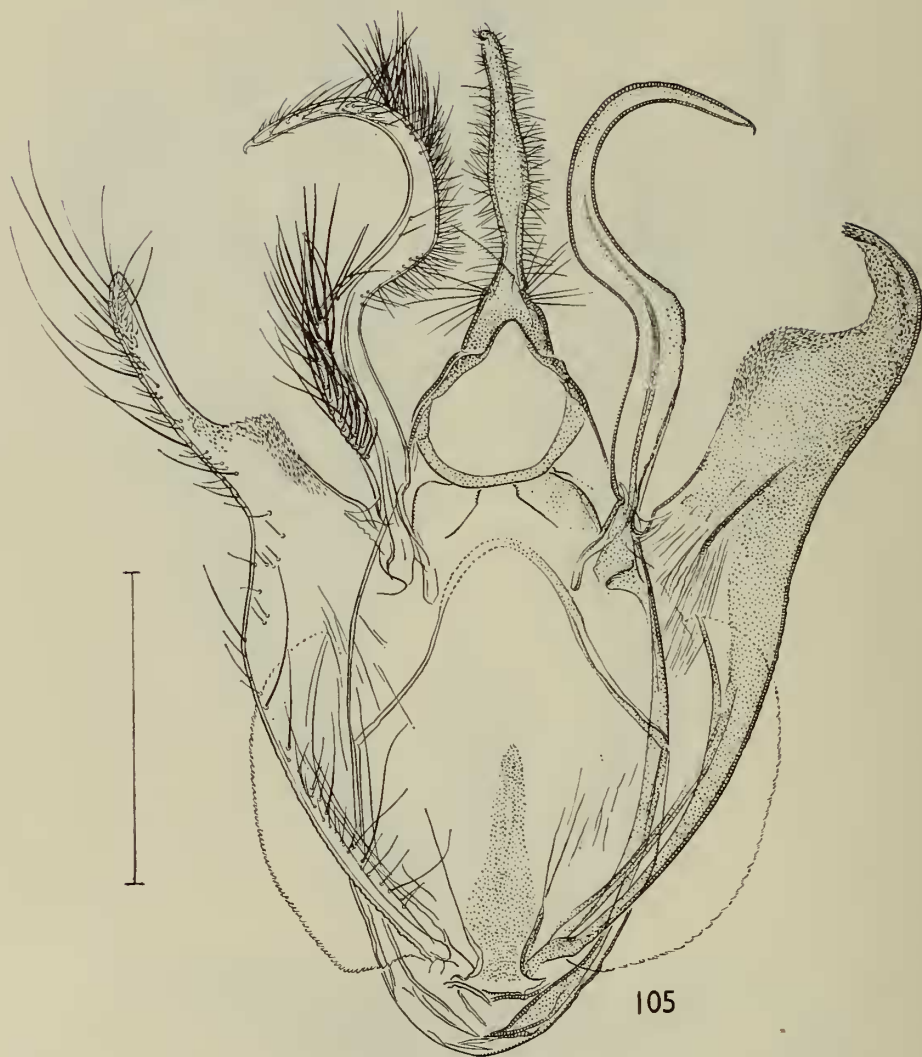
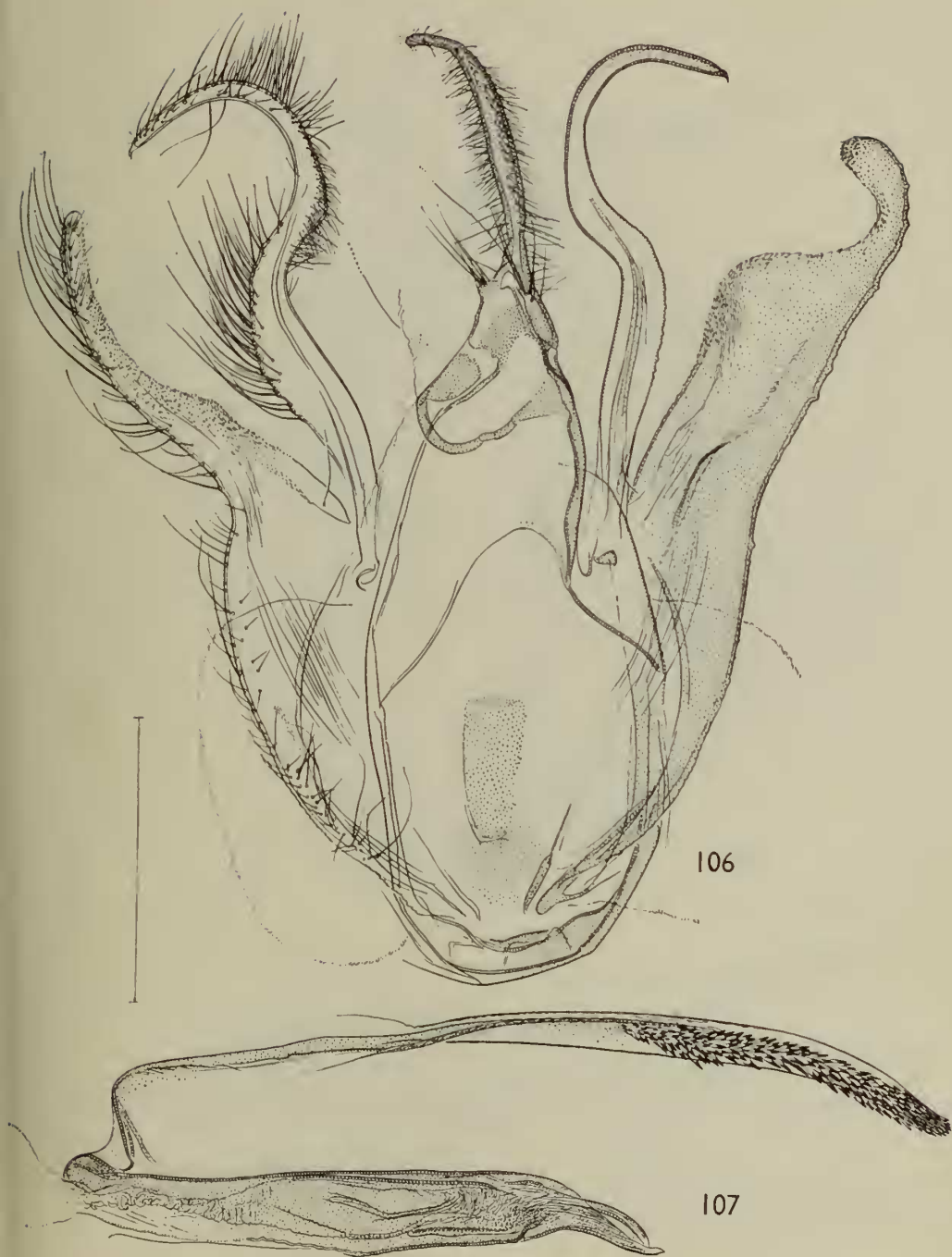
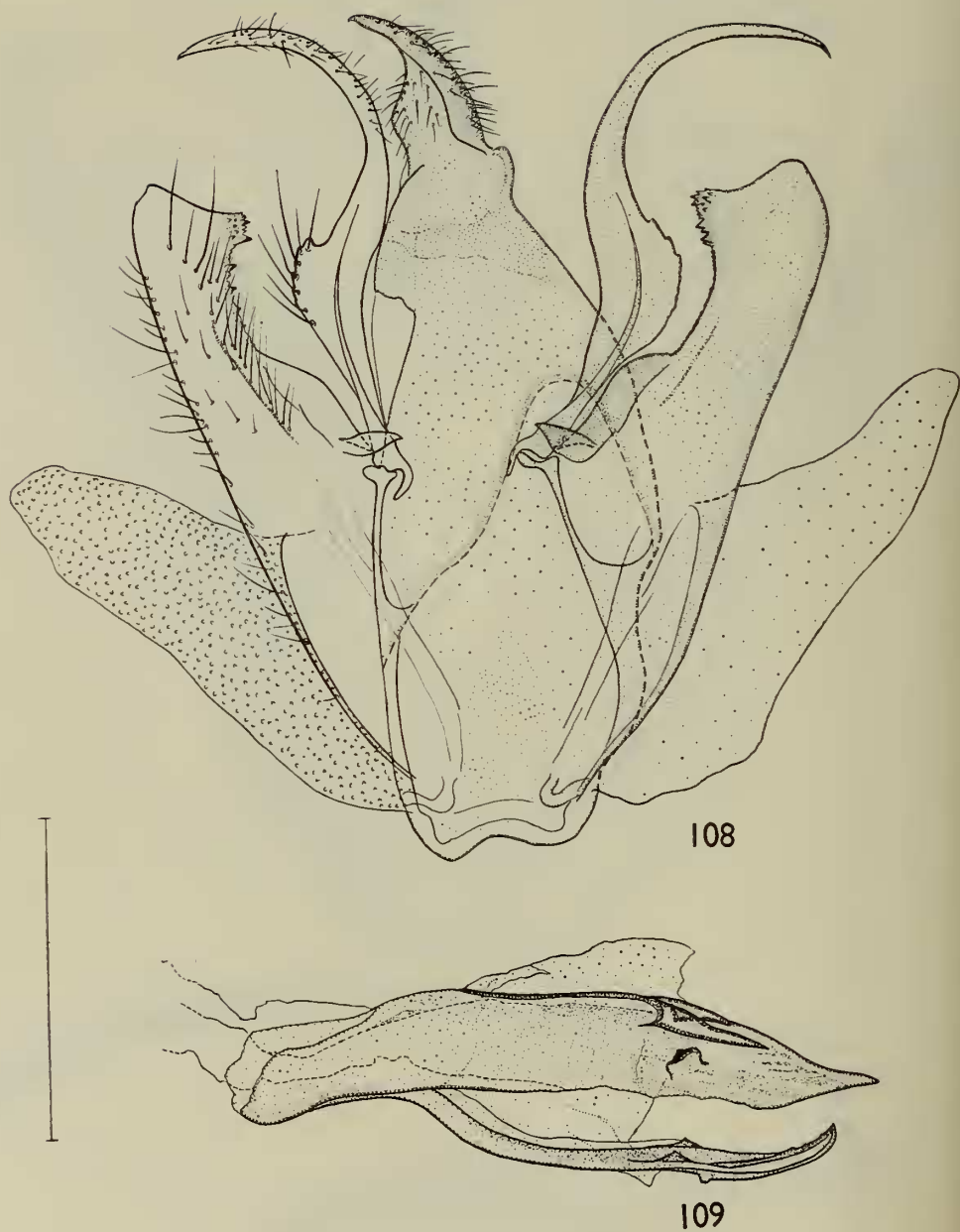


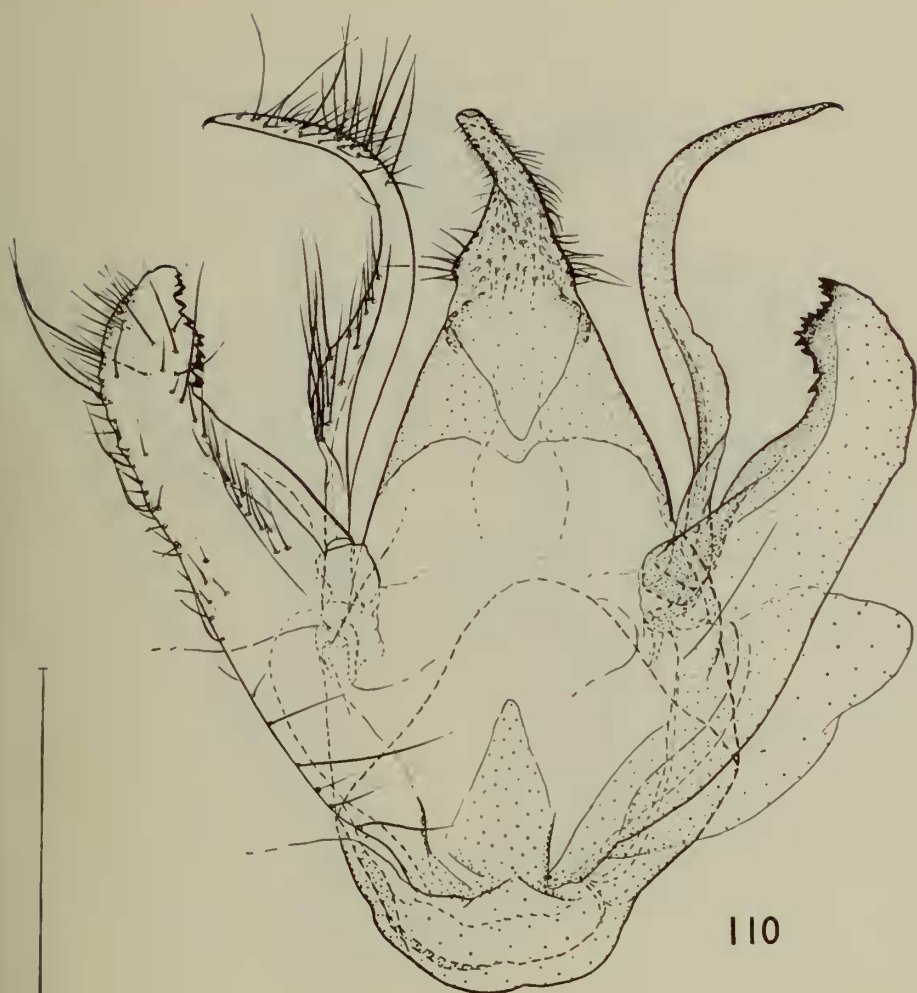
FIG. 105. *Zamarada regularis arcuata*, genitalia (A.S.) 105, ♂.



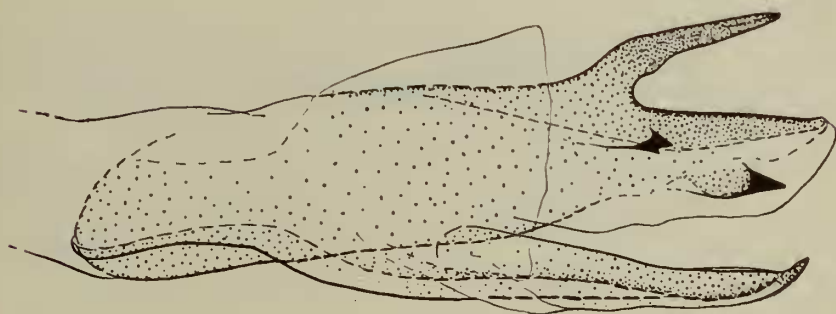
FIGS 106, 107. *Zamarada schalida*, genitalia (A.S.). 106, ♂; 107, aedeagus.



FIGS 108, 109. *Zamarada pringlei*, genitalia (M.L.). 108, ♂; 109 aedeagus.



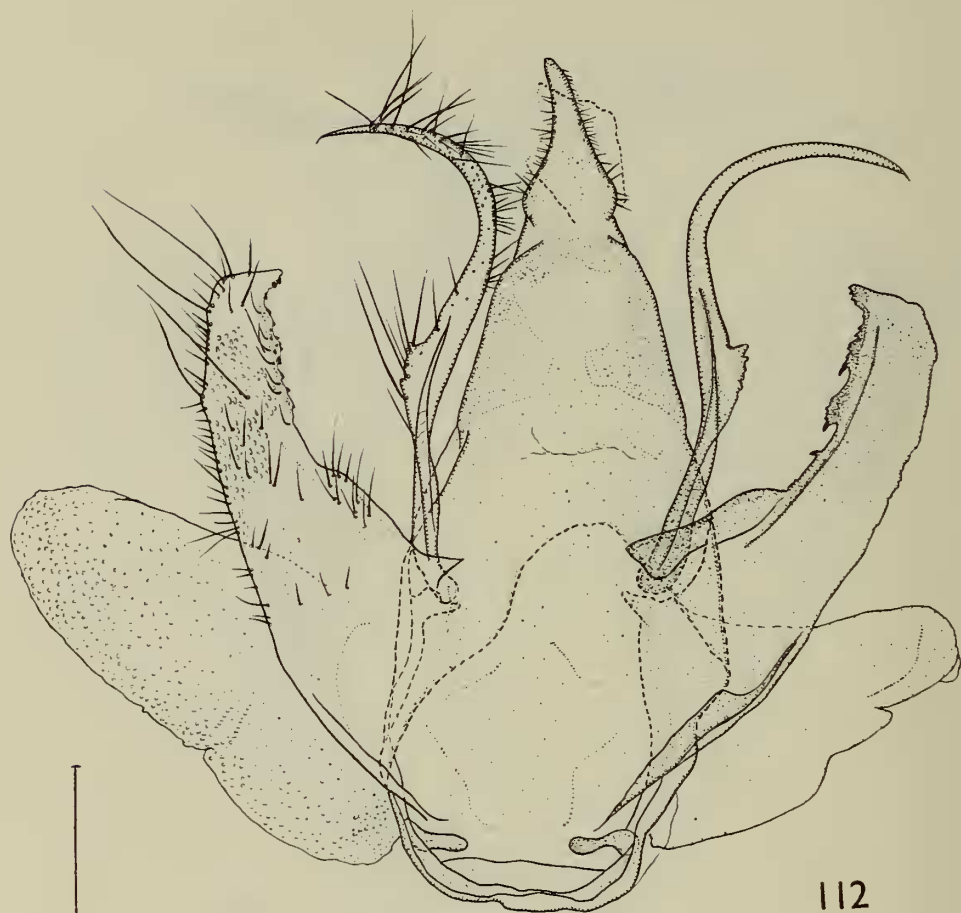
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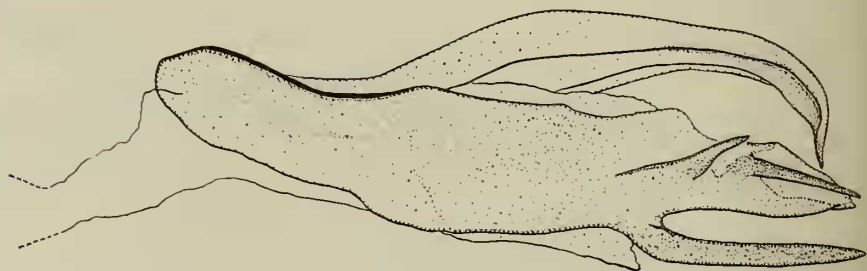
111

FIGS 110, 111. *Zamarada dentata*, genitalia (J.A.). 110, ♂; 111, aedeagus.



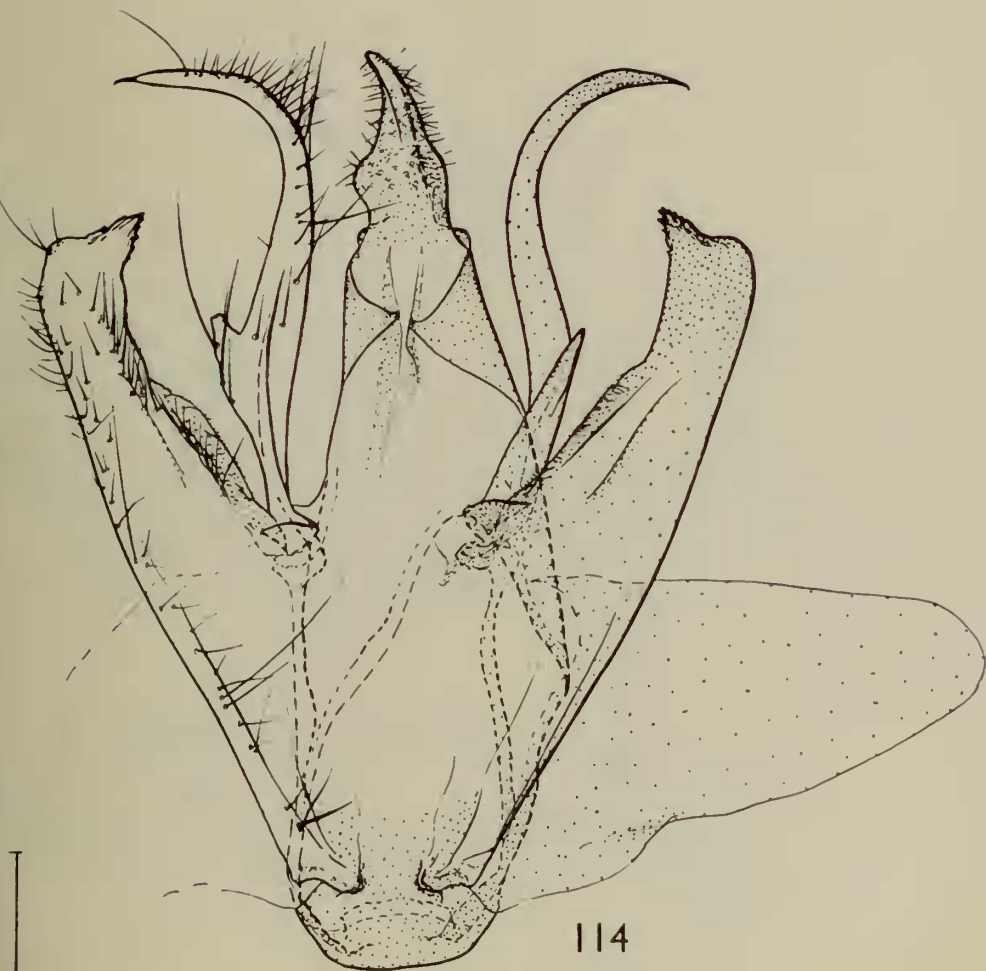


112

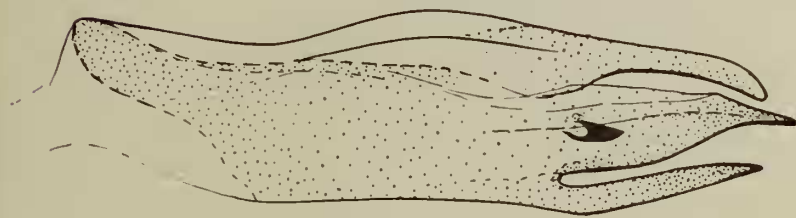


113

FIGS 112, 113. *Zamarada psectra*, genitalia (M.L.). 112, ♂; 113, aedeagus.

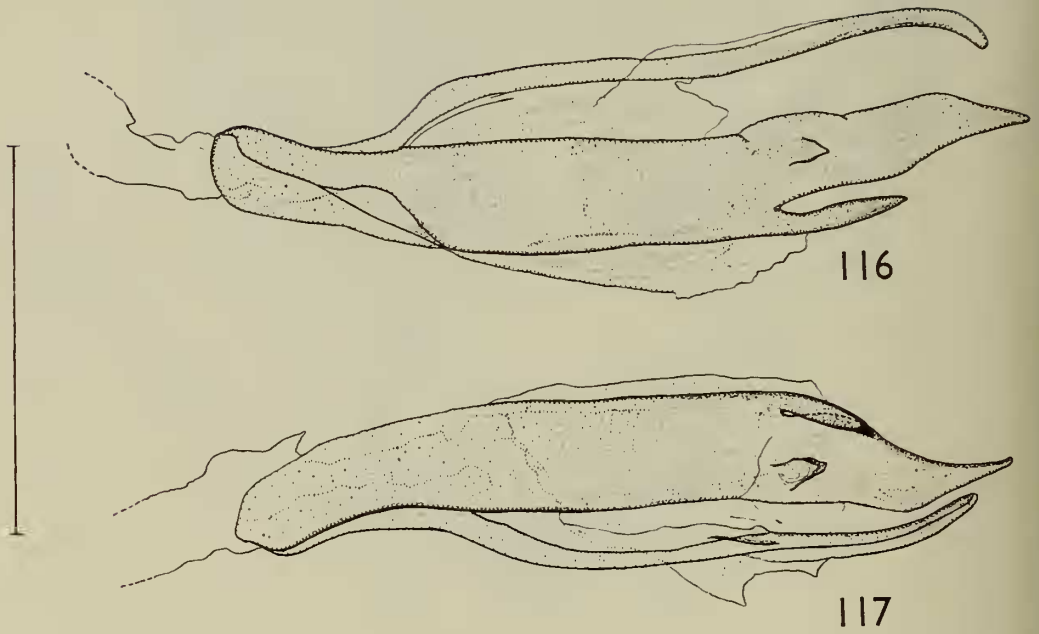


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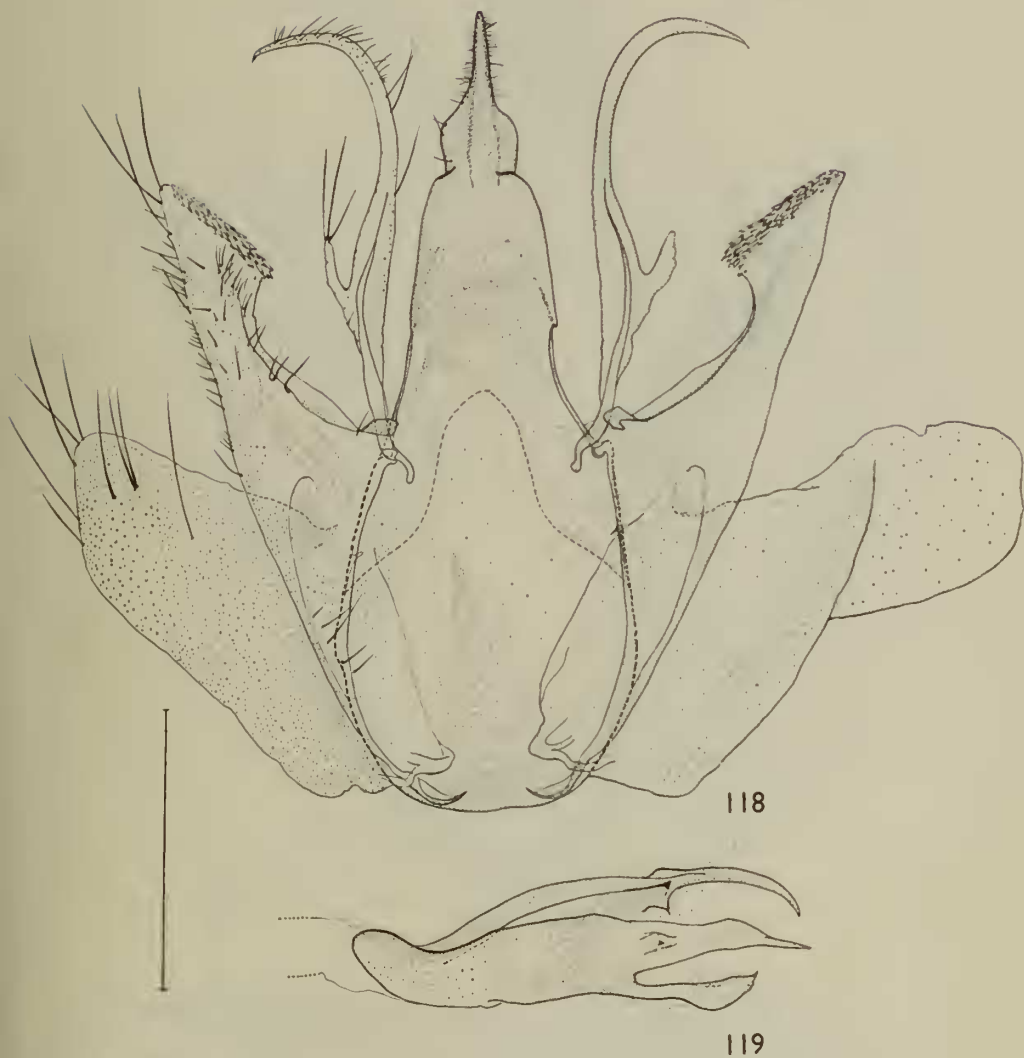


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FIGS 114, 115. *Zamarada excavata excavata*, genitalia (J.A.). 114, ♂; 115, aedeagus.

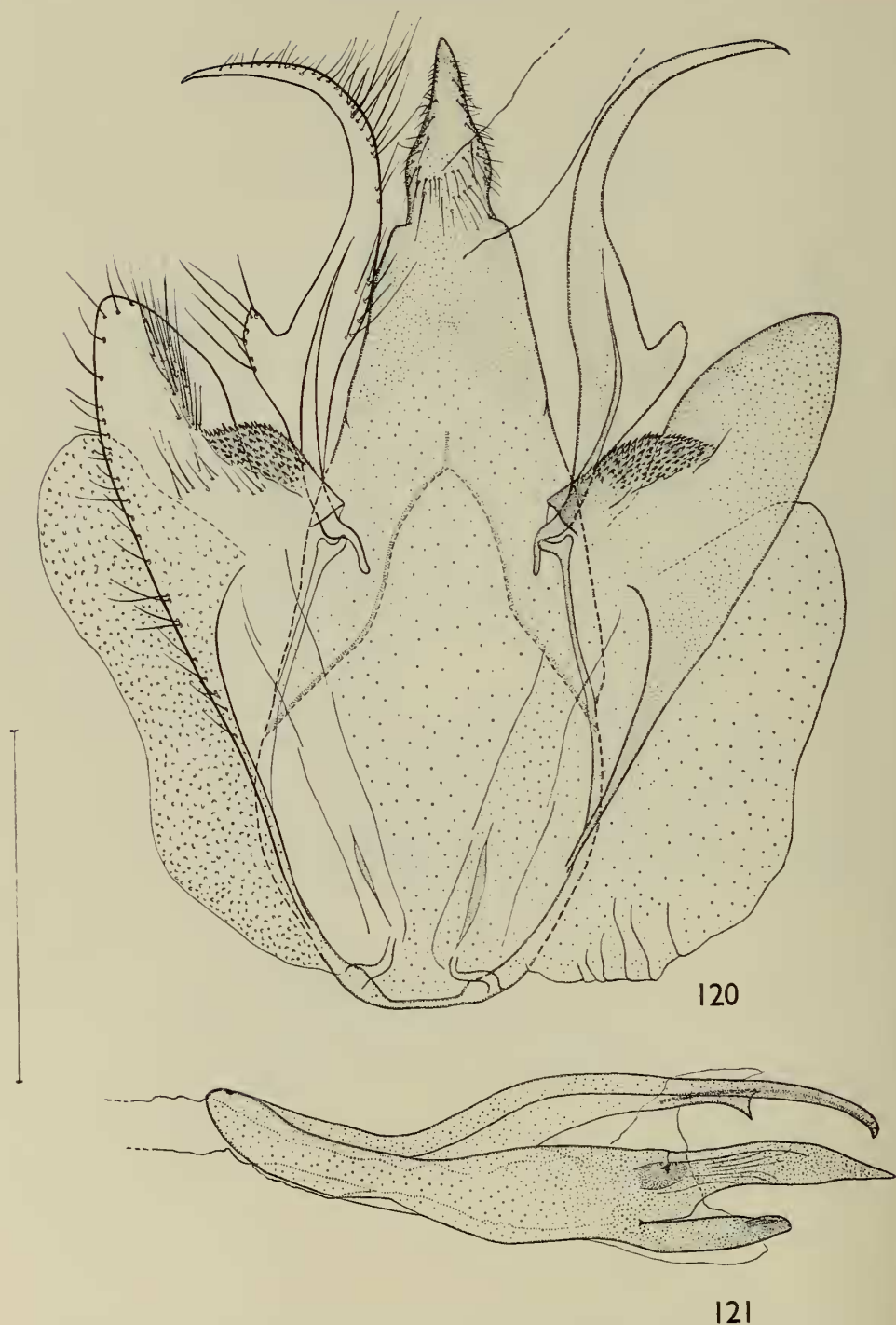


FIGS 116, 117. *Zamarada*, genitalia (M.L.). 116, *excavata acis*, aedeagus; 117, *excavata pollex*, aedeagus.

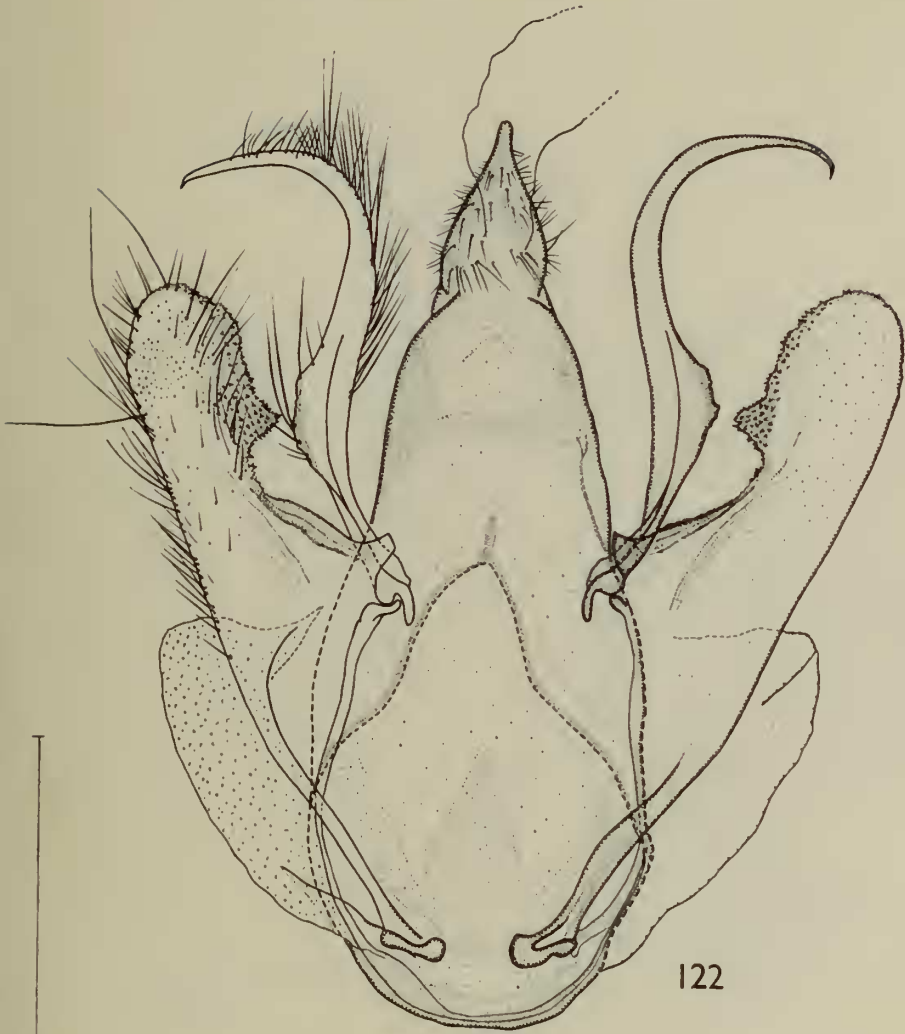


FIGS 118, 119. *Zamarada episema*, genitalia (M.L.). 118, ♂; 119, aedeagus.





FIGS 120, 121. *Zamarada dasysceles*, genitalia (M.L.). 120, ♂; 121, aedeagus.

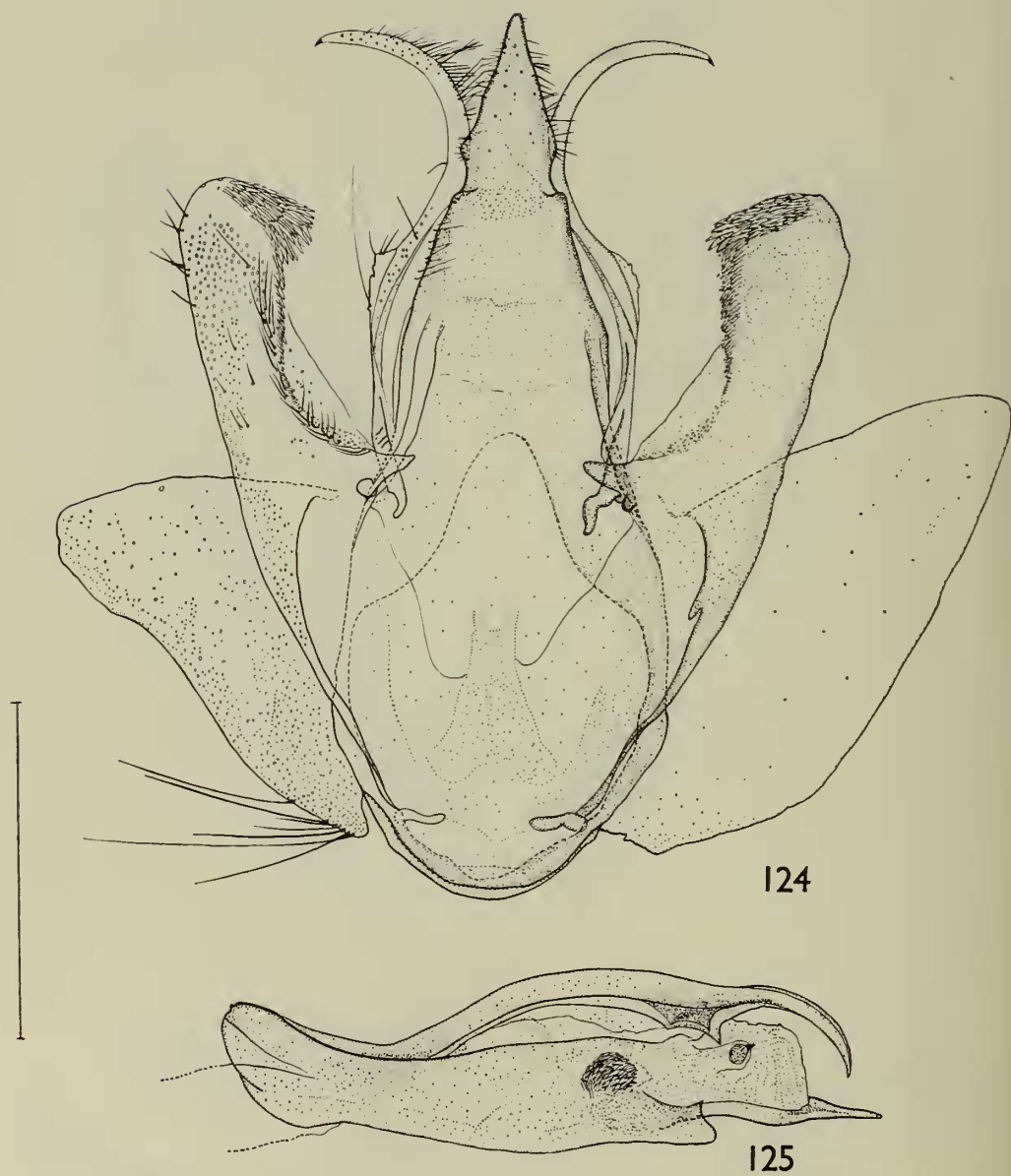


122

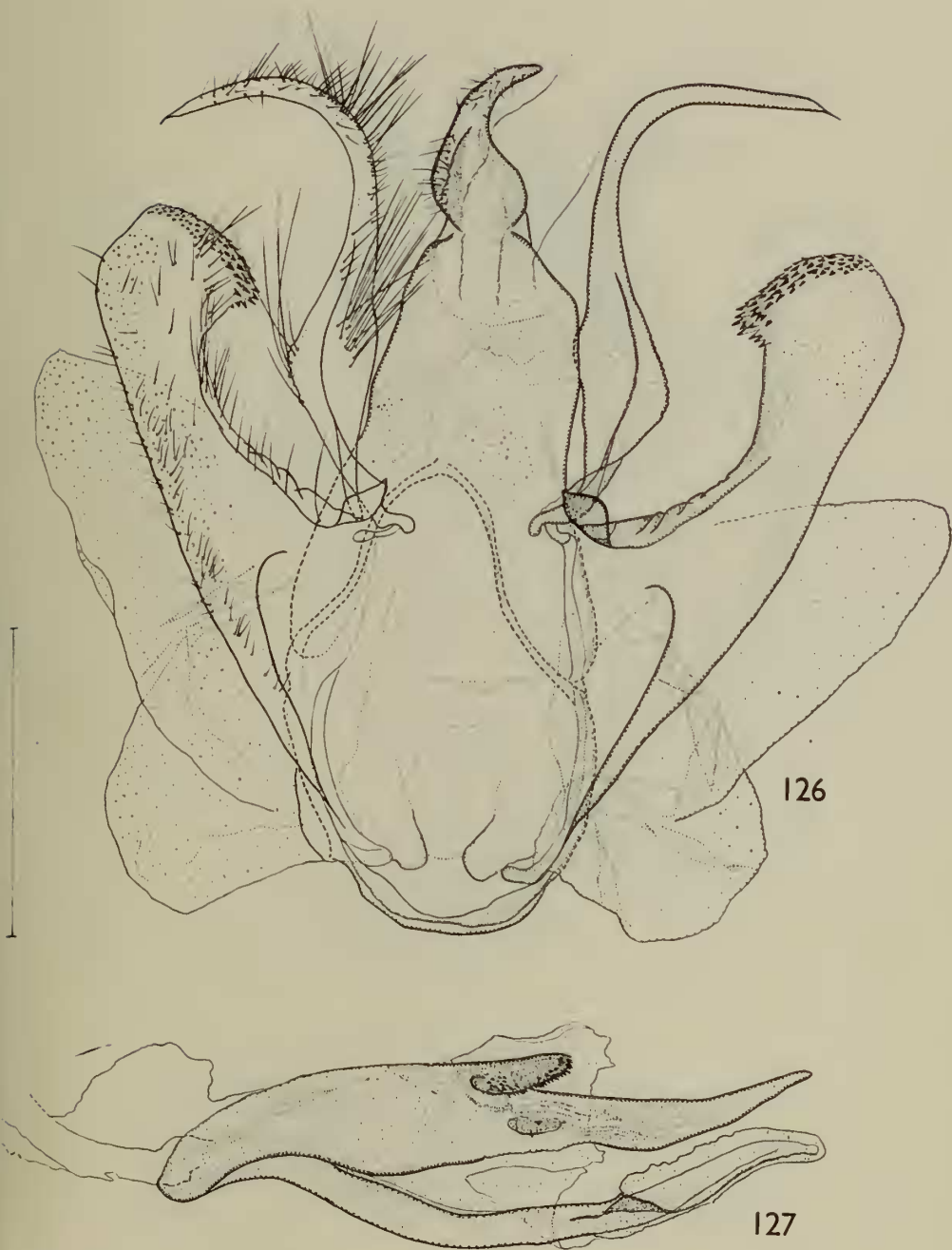


123

FIGS 122, 123. *Zamarada laciniata*, genitalia (M.L.). 122, ♂; 123, aedeagus.

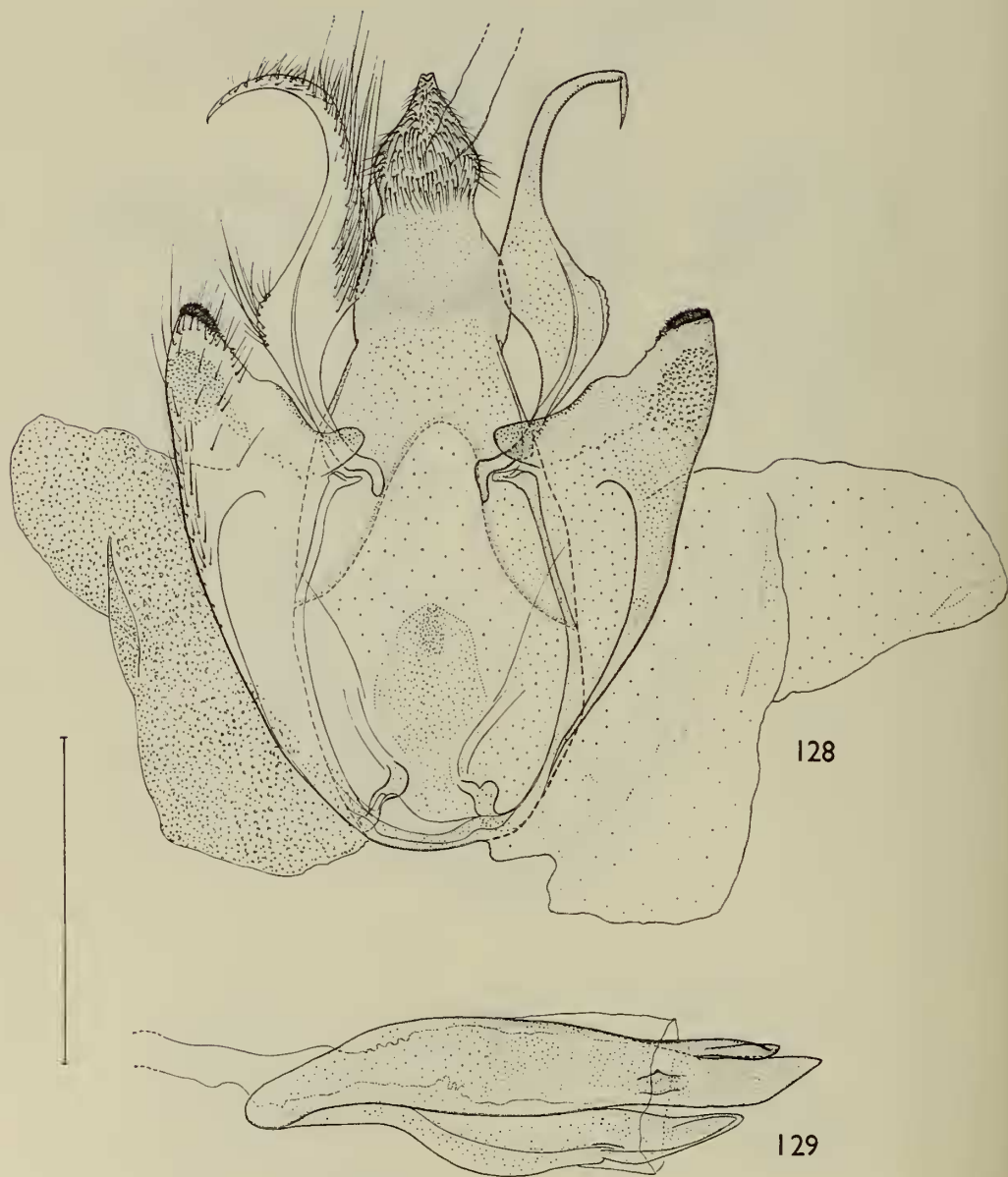


FIGS 124, 125. *Zamarada dyscapna*, genitalia (M.L.). 124, ♂; 125, aedeagus.



FIGS 126, 127. *Zamarada radula*, genitalia (M.L.). 126, ♂; 127, aedeagus.

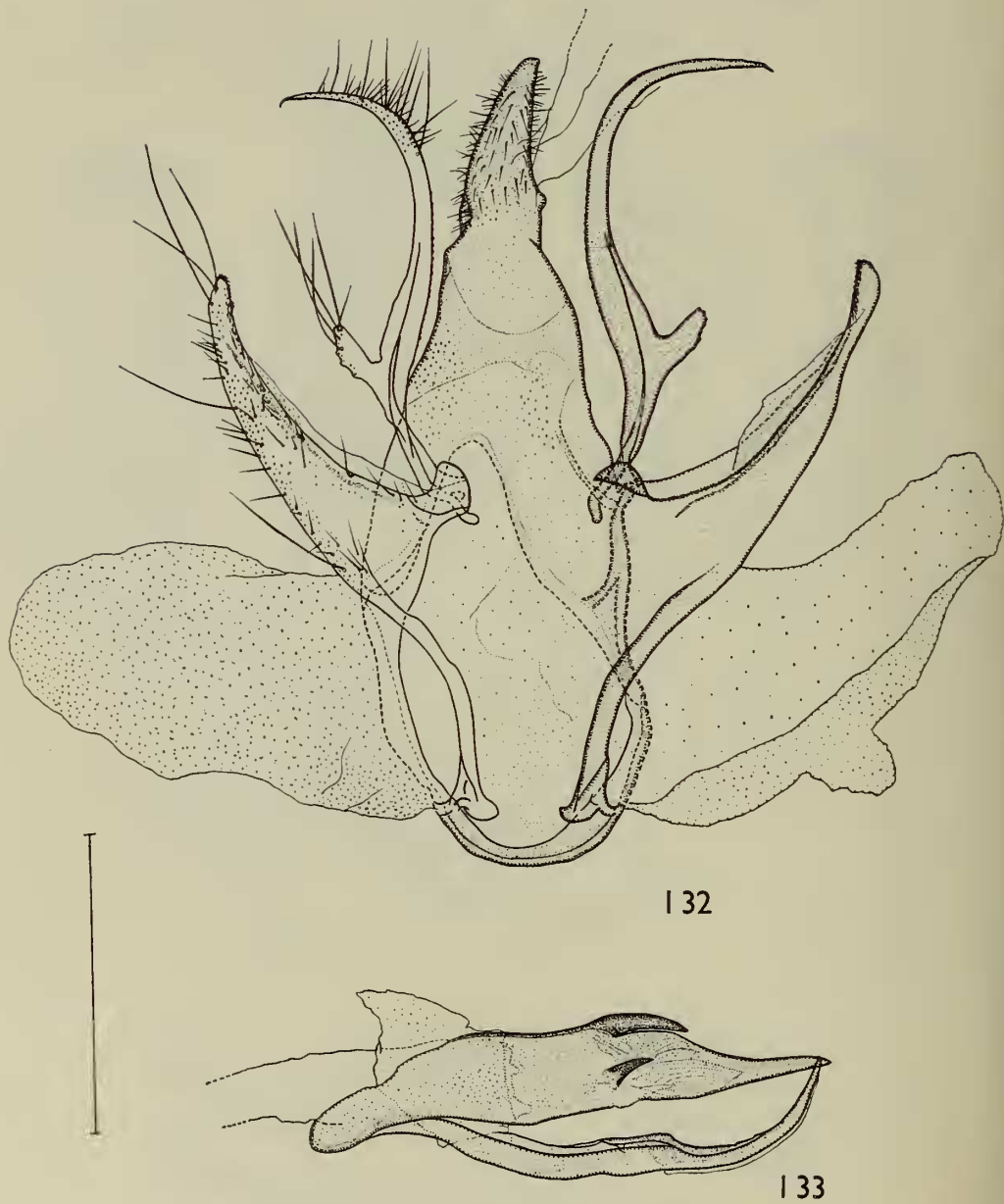




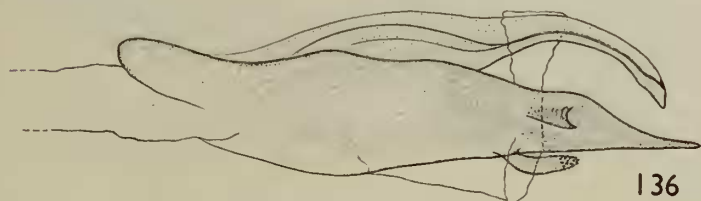
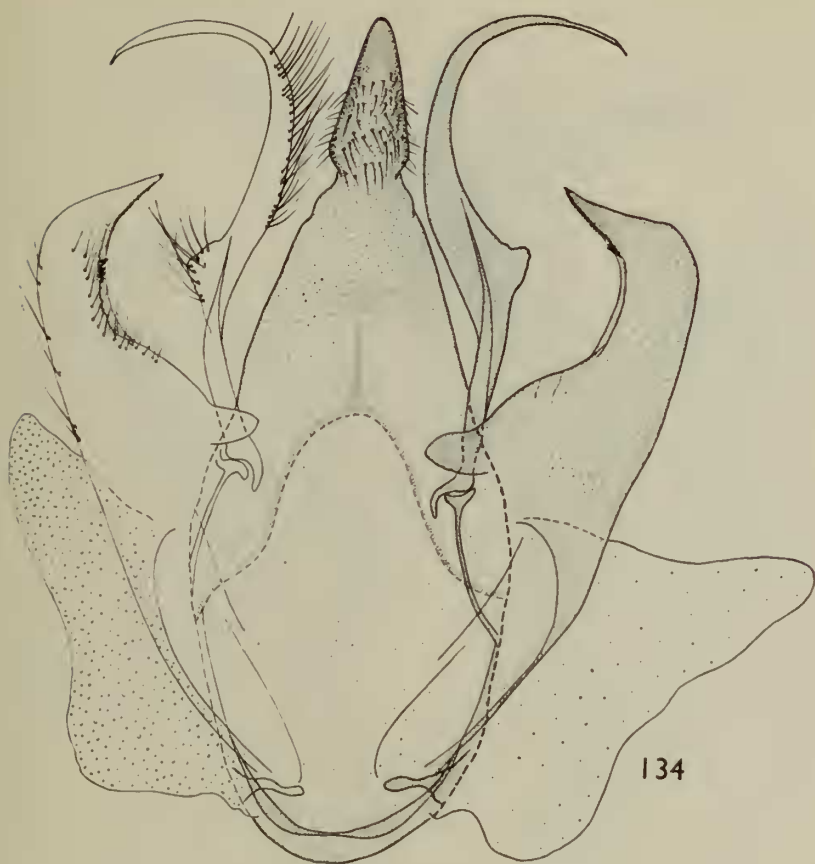
FIGS 128, 129. *Zamarada cinereata*, genitalia (M.L.). 128, ♂; 129, aedeagus.



FIGS 130, 131. *Zamarada fusticula*, genitalia (M.L.). 130, ♂; 131, aedeagus.

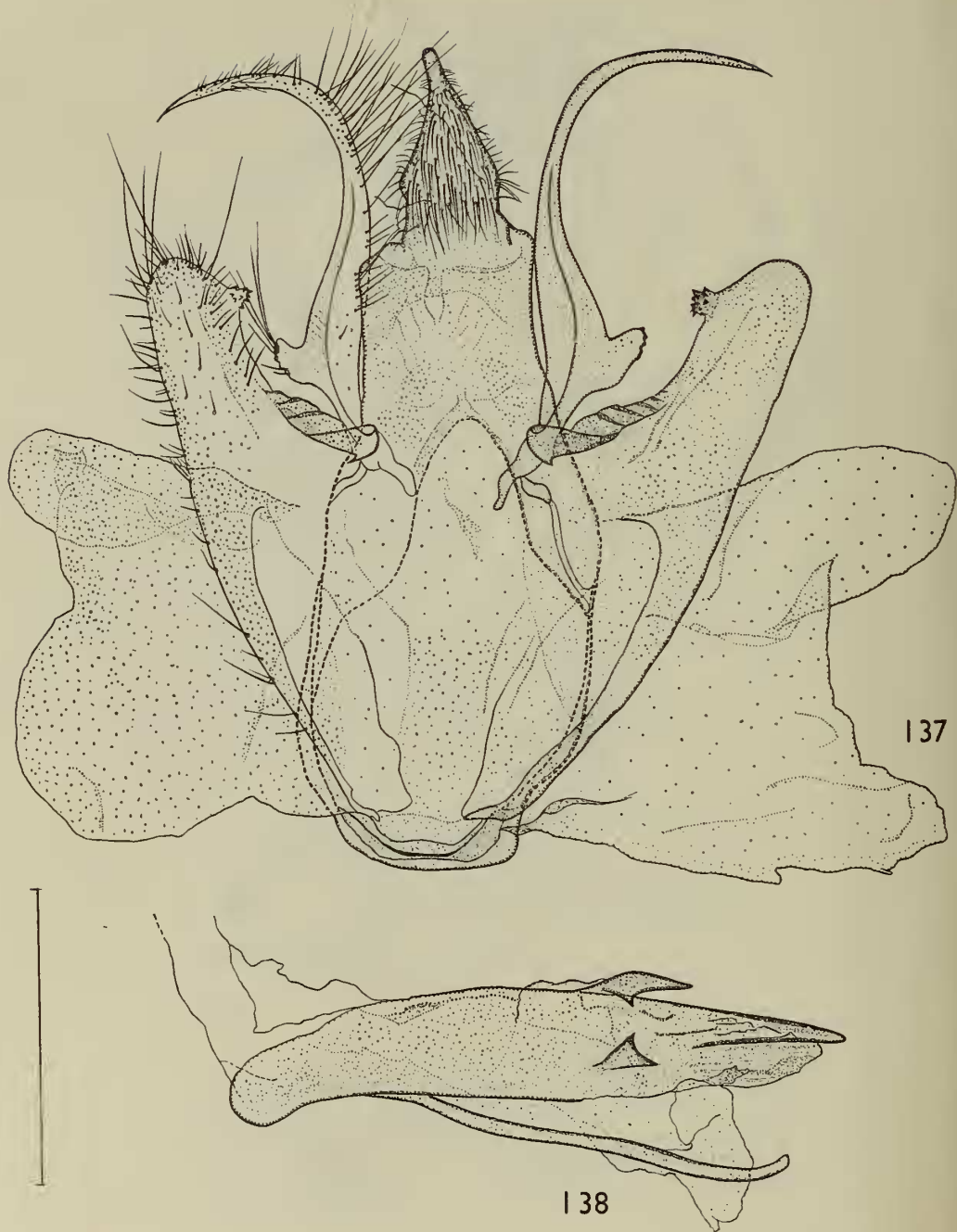


FIGS 132, 133. *Zamarada sicula*. genitalia (M.L.). 132, ♂; 133, aedeagus.

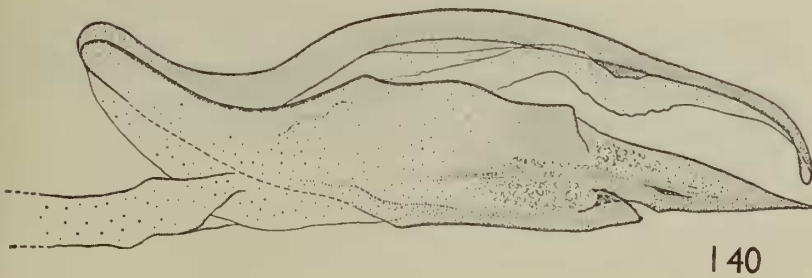
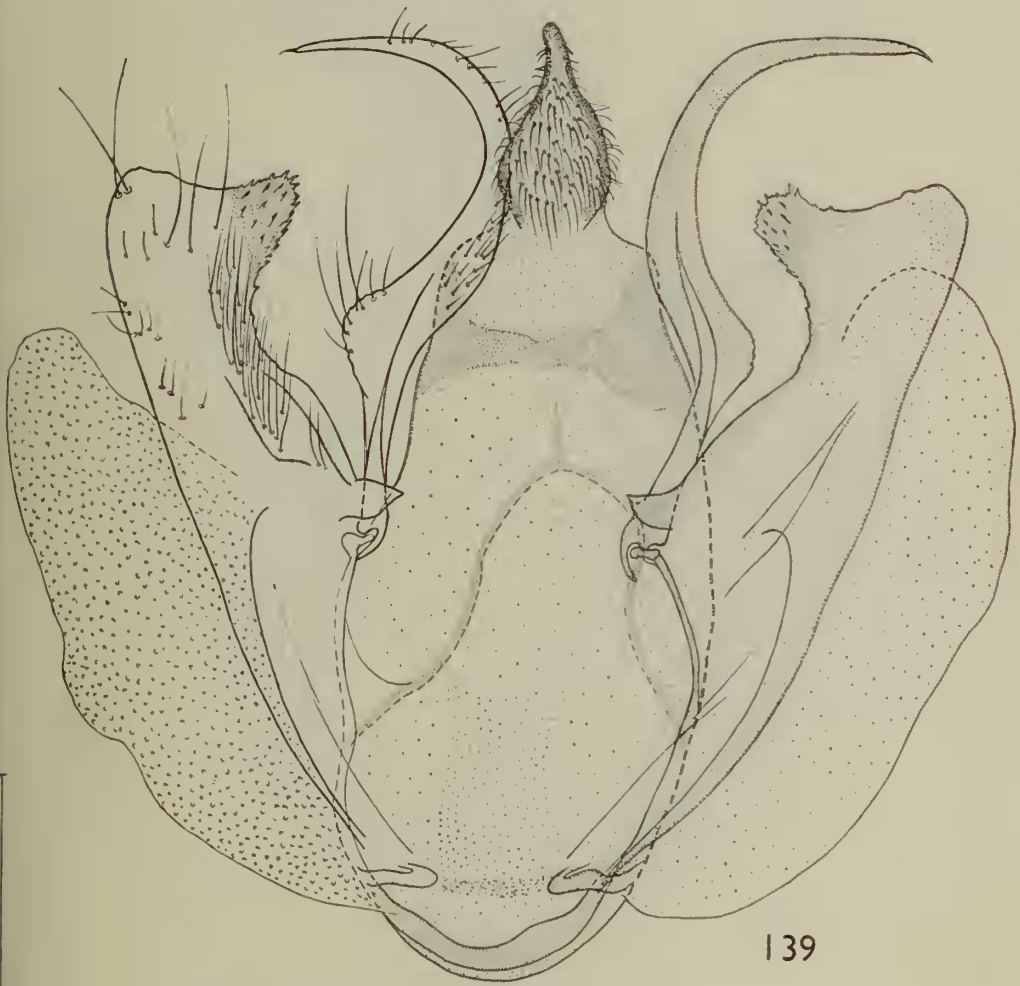


FIGS 134-136. *Zamarada*, genitalia (M.L.). 134, 135, *manifesta*. 134, ♂; 135, aedeagus. 136, *dargei*, aedeagus.

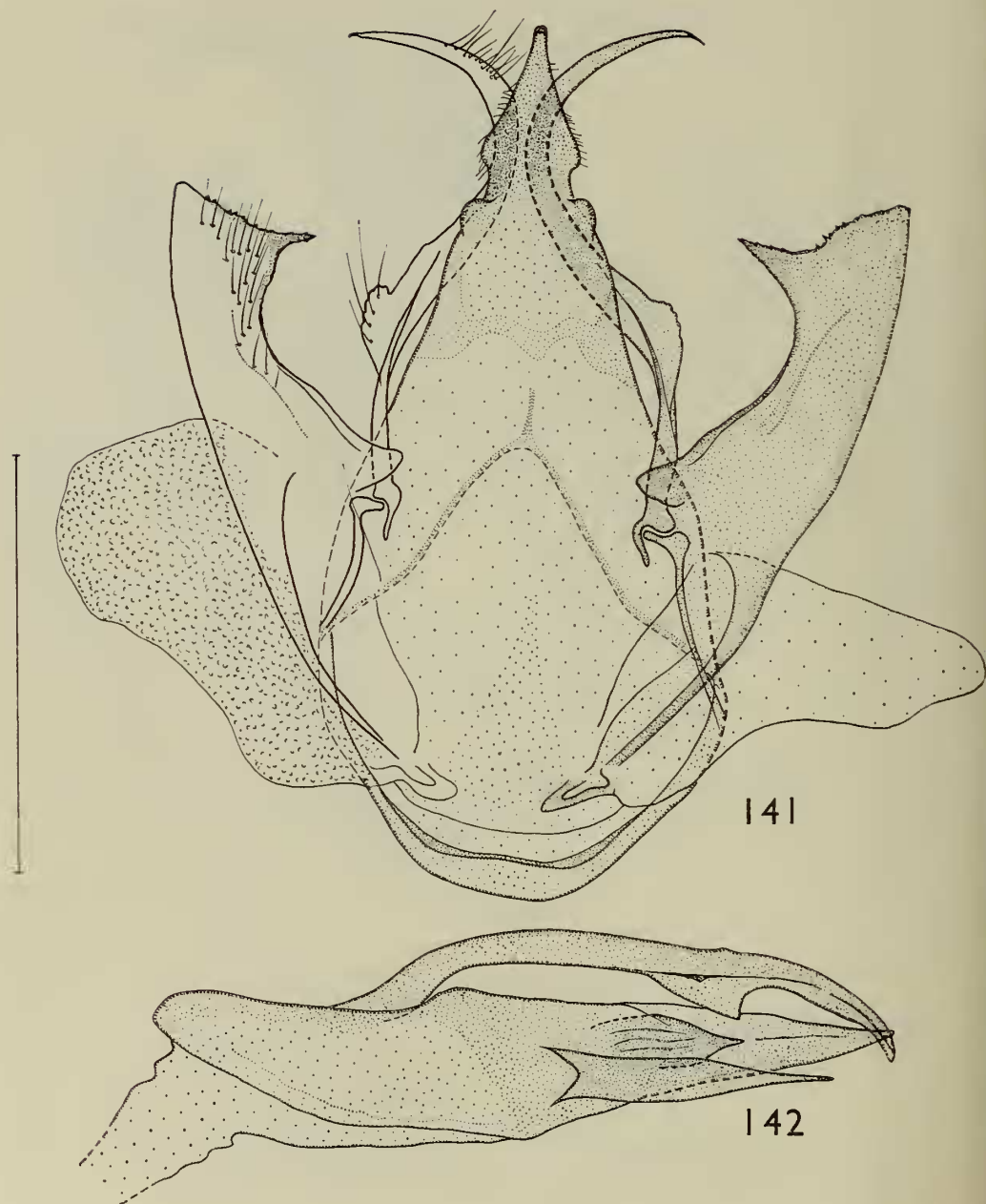




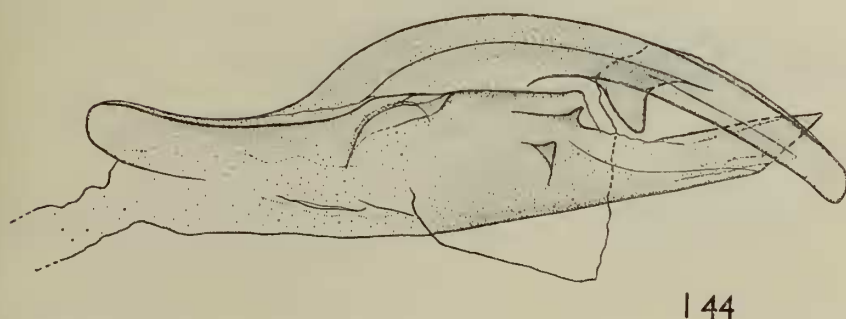
FIGS 137, 138. *Zamarada hero*, genitalia (M.L.). 137, ♂; 138, aedeagus.



FIGS 139, 140. *Zamarada corymbophora*, genitalia (M.L.). 139, ♂; 140, aedeagus.

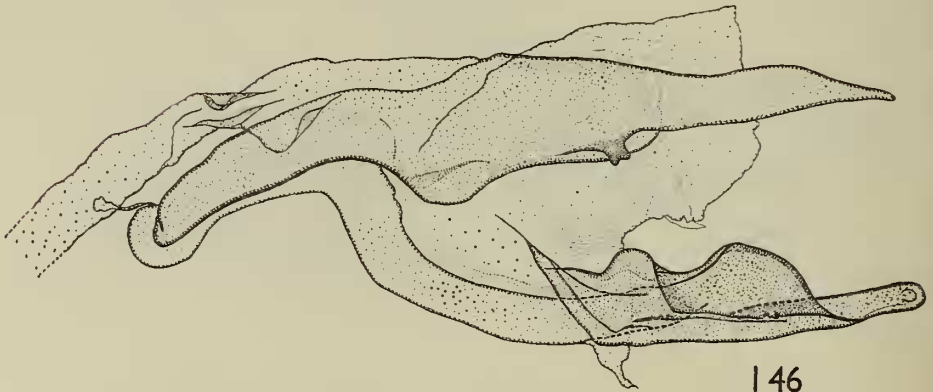
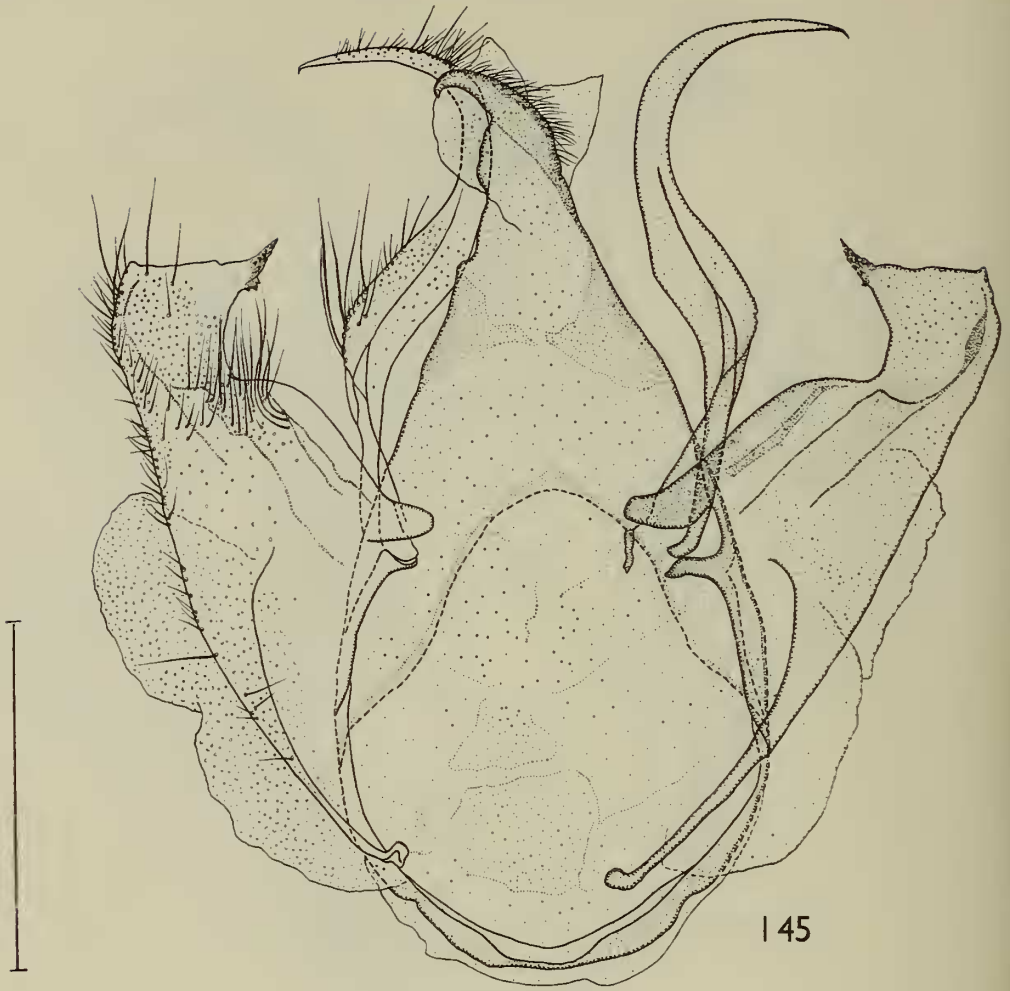


FIGS 141, 142. *Zamarada aclys*, genitalia (M.L.). 141, ♂; 142, aedeagus.

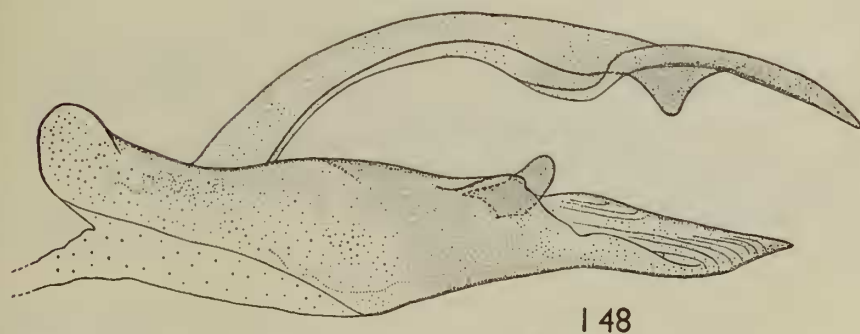


FIGS 143, 144. *Zamarada thalia*, genitalia (M.L.). 143, ♂; 144, aedeagus.

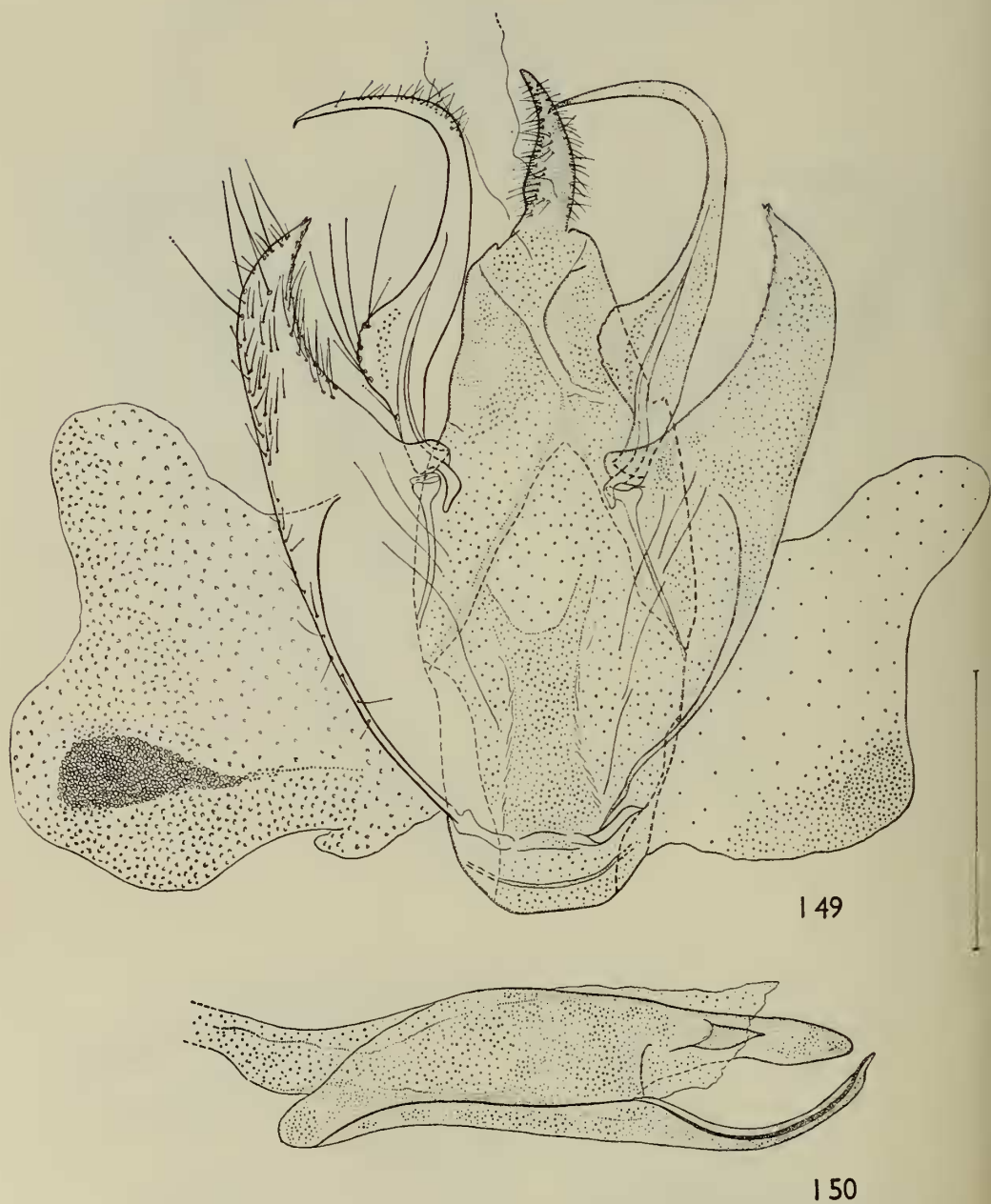




FIGS 145, 146. *Zamarada astales*, genitalia (M.L.). 145, ♂; 146, aedeagus.



FIGS 147, 148. *Zamarada pentthesis*, genitalia (M.L.). 147, ♂; 148, aedeagus.



FIGS 149, 150. *Zamarada melpomene*, genitalia (M.L.). 149, ♂; 150, aedeagus.



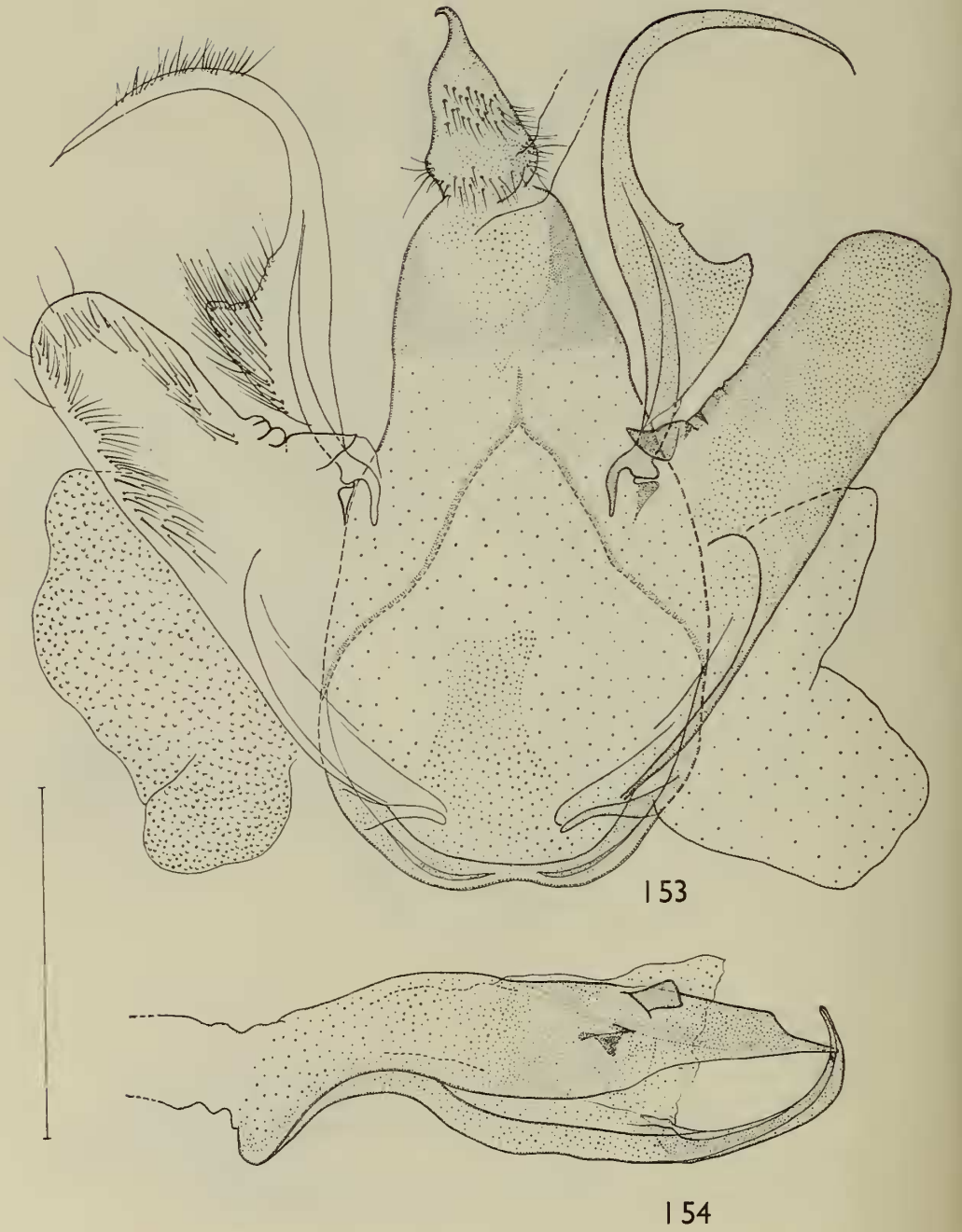
151



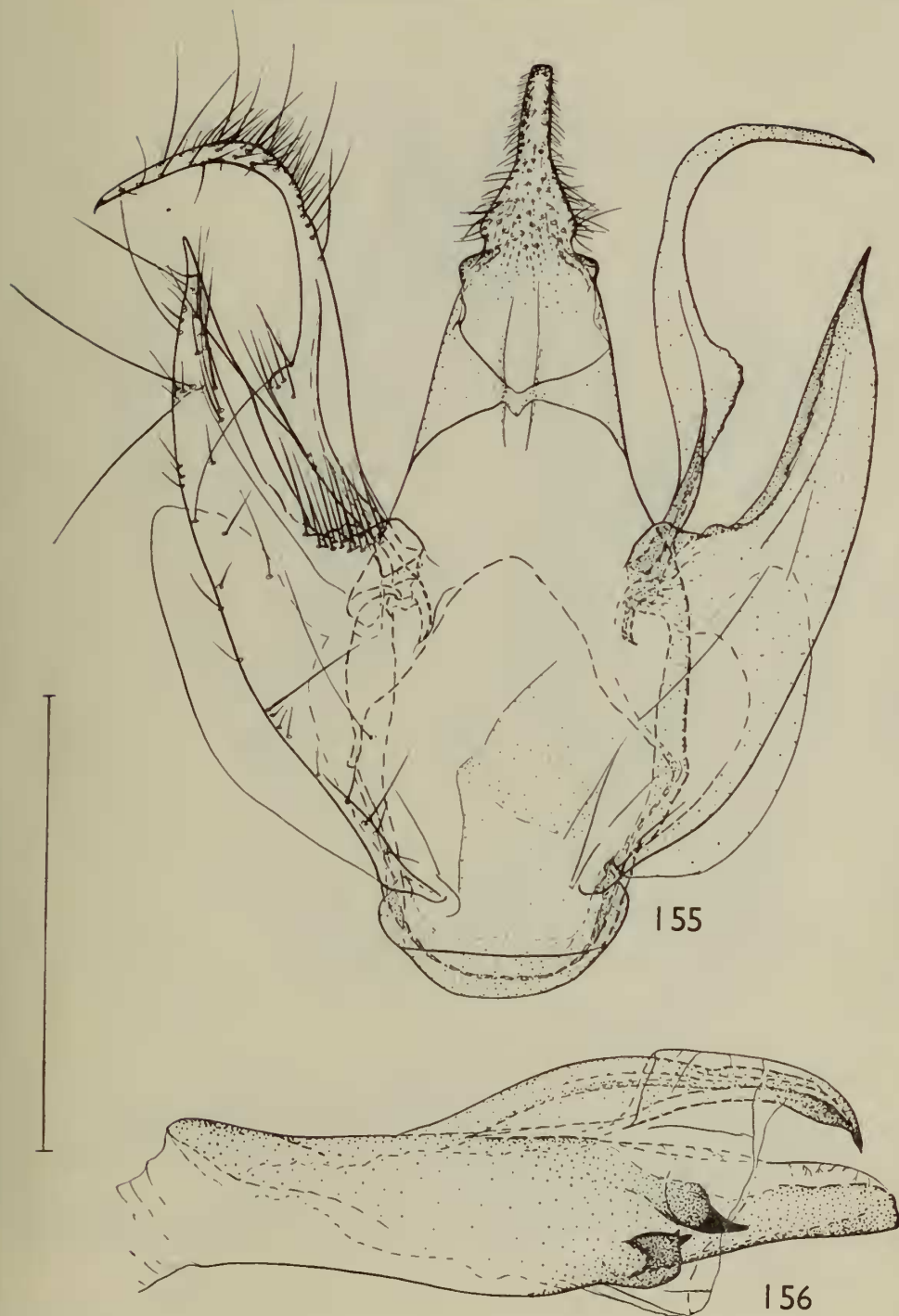
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FIGS 151, 152. *Zamarada incompta*, genitalia (A.P.). 151, ♂; 152, aedeagus.

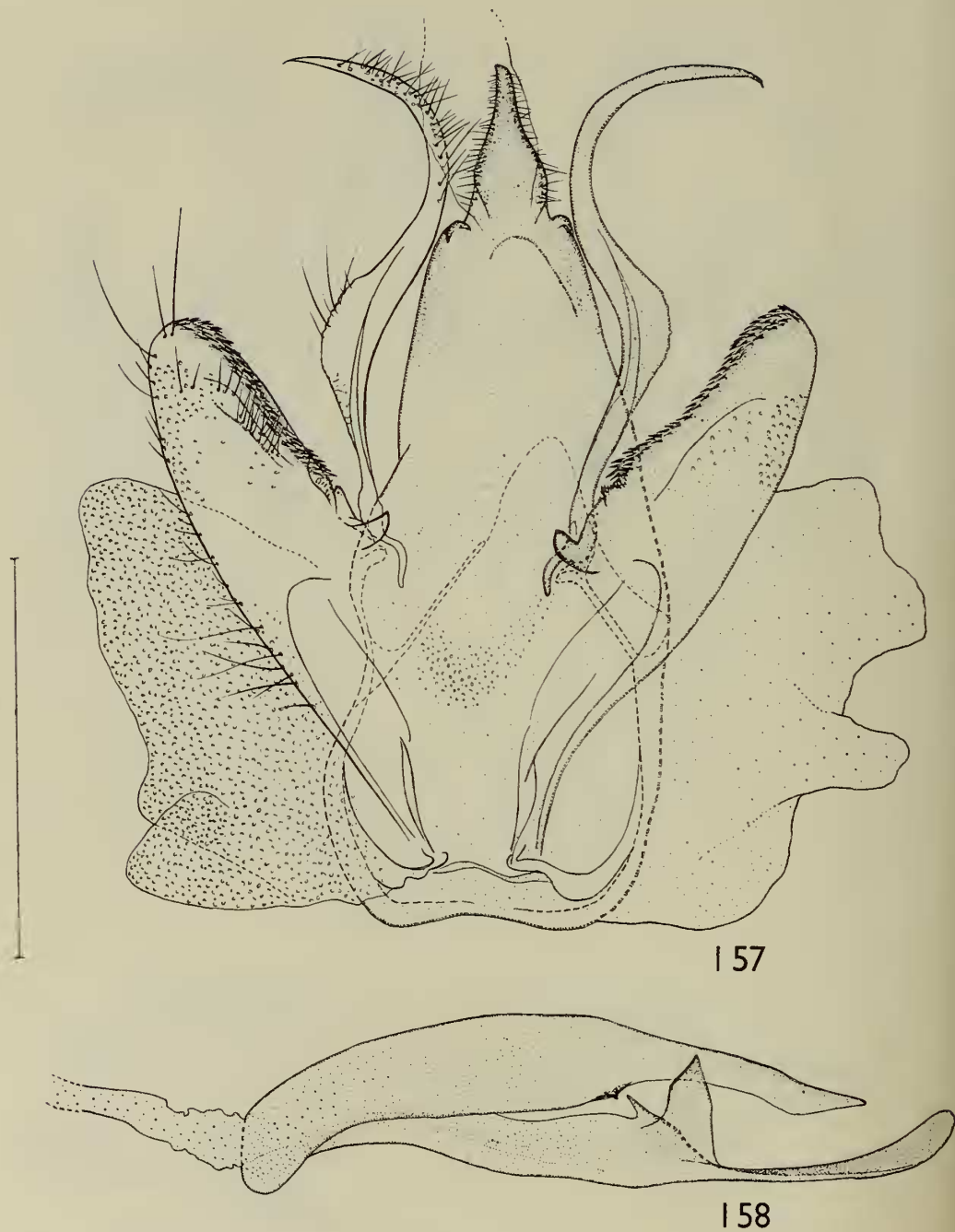




FIGS 153, 154. *Zamarada setosa*, genitalia (M.L.). 153, ♂; 154, aedeagus.



FIGS 155, 156. *Zamarada oxybeles*, genitalia (J.A.). 155, ♂, 156, aedeagus.



FIGS 157, 158. *Zamarada subinterrupta*, genitalia (M.L.). 157, ♂; 158, aedeagus.



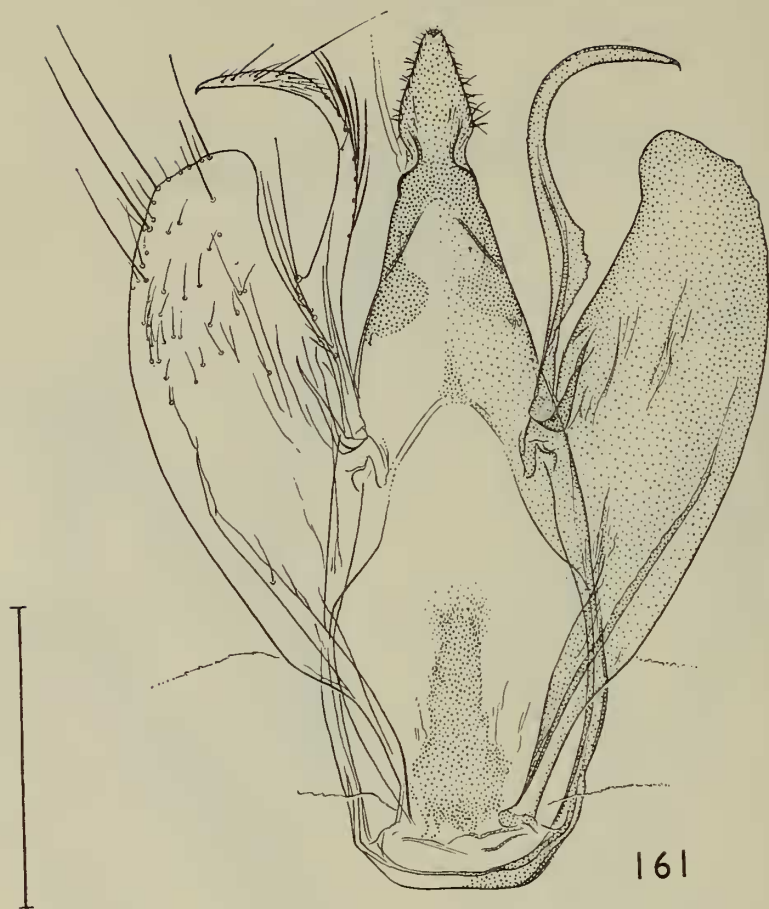
159



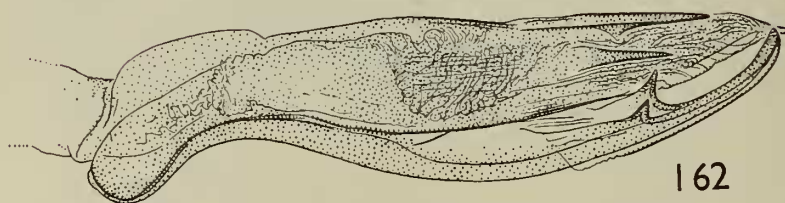
160

FIGS 159. 160. *Zamarada lophobela*, genitalia (M.L.). 159, ♂; 160, aedeagus.

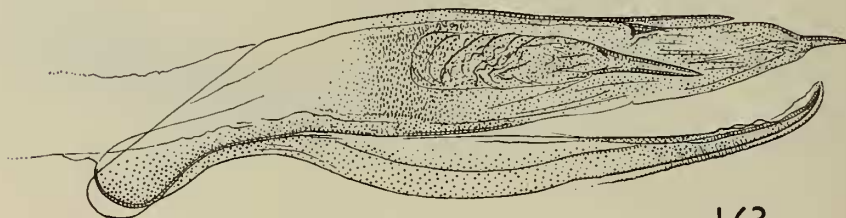




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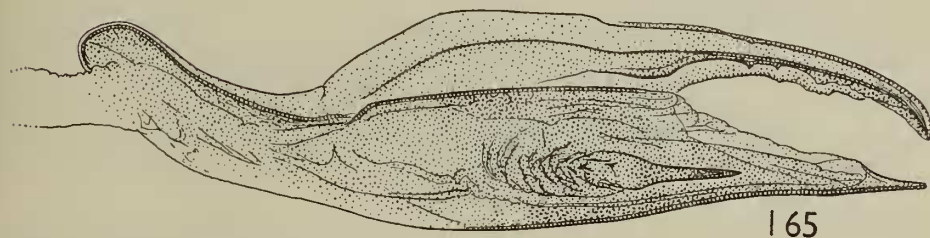


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FIGS 161-163. *Zamarada*, genitalia (A.S.). 161, 162, *protrusa protrusa*. 161, ♂; 162, aedeagus. 163, *protrusa serrula*, aedeagus.



FIGS 164, 165. *Zamarada sinecalcarata*, genitalia (A.S.). 164, ♂, 165, aedeagus.

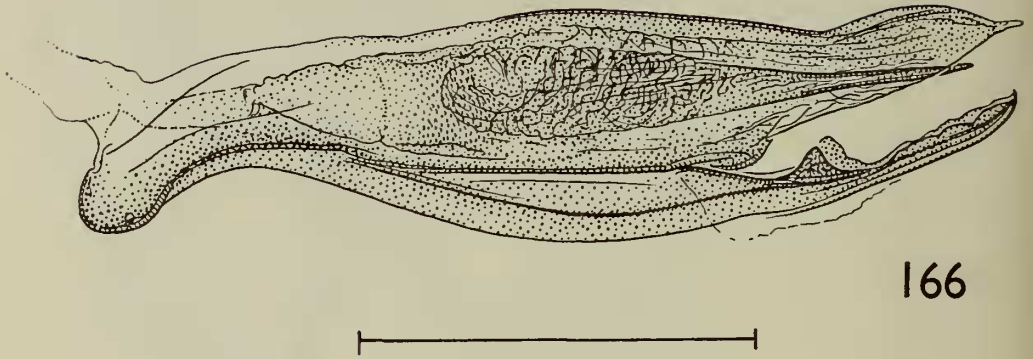
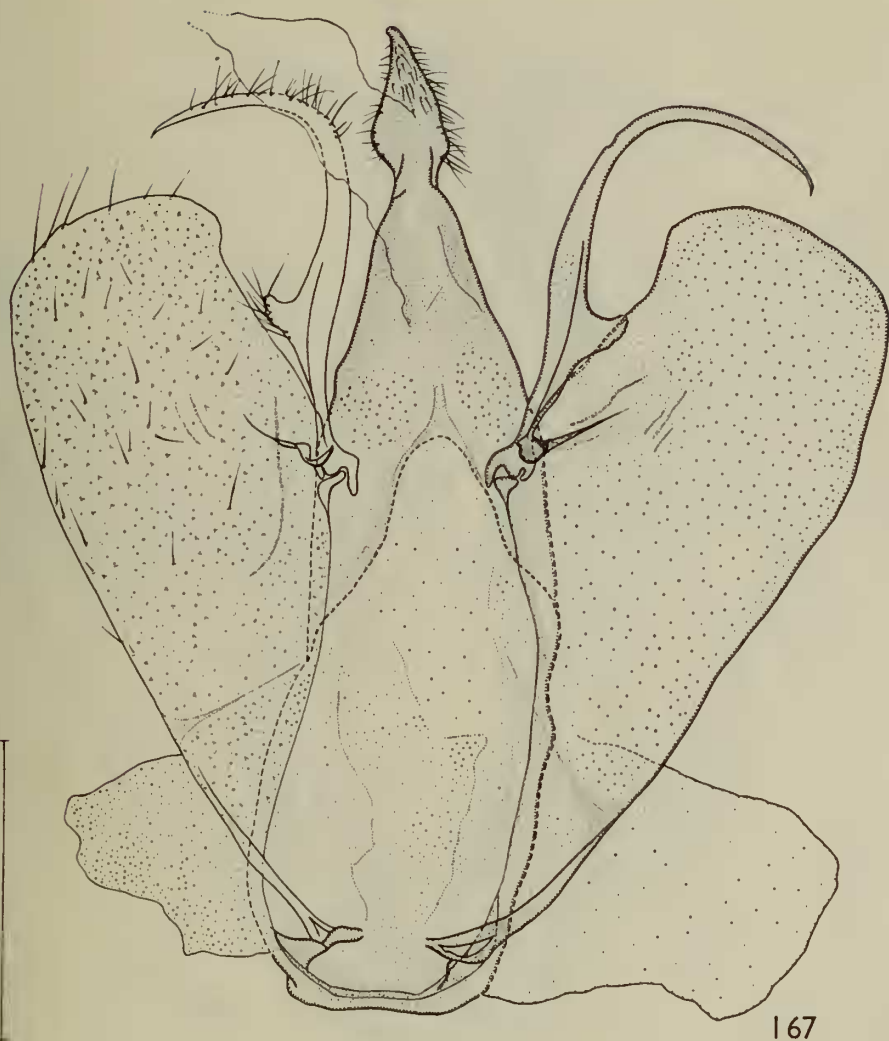
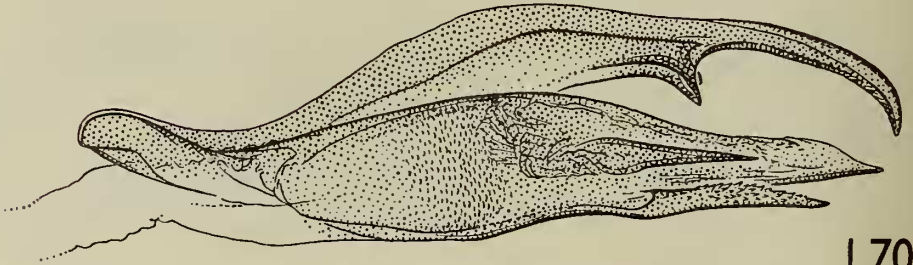
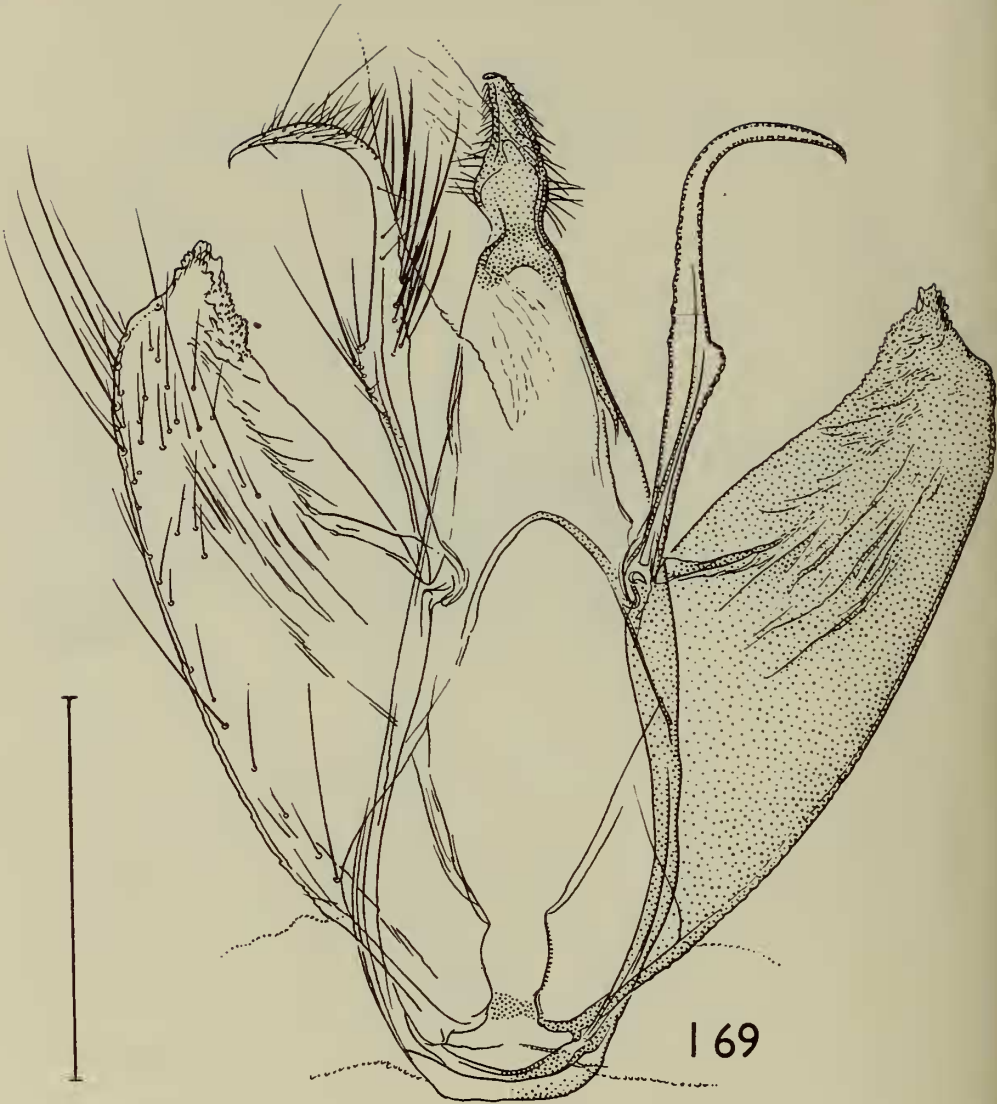


FIG. 166. *Zamarada lanceolata*, aedeagus (A.S.).

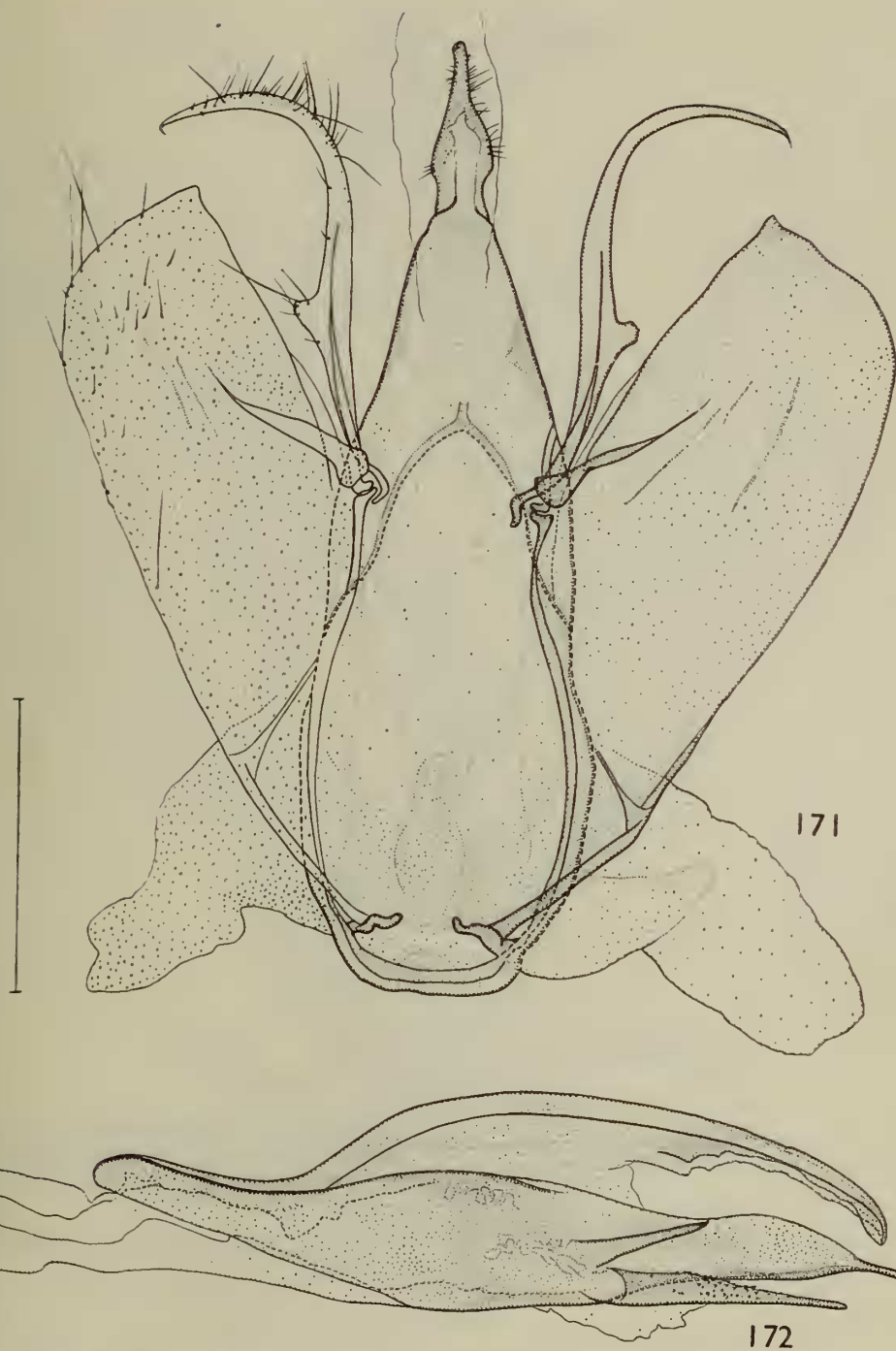


FIGS 167, 168. *Zamarada disparata*, genitalia (M.L.). 167, ♂; 168, aedeagus.

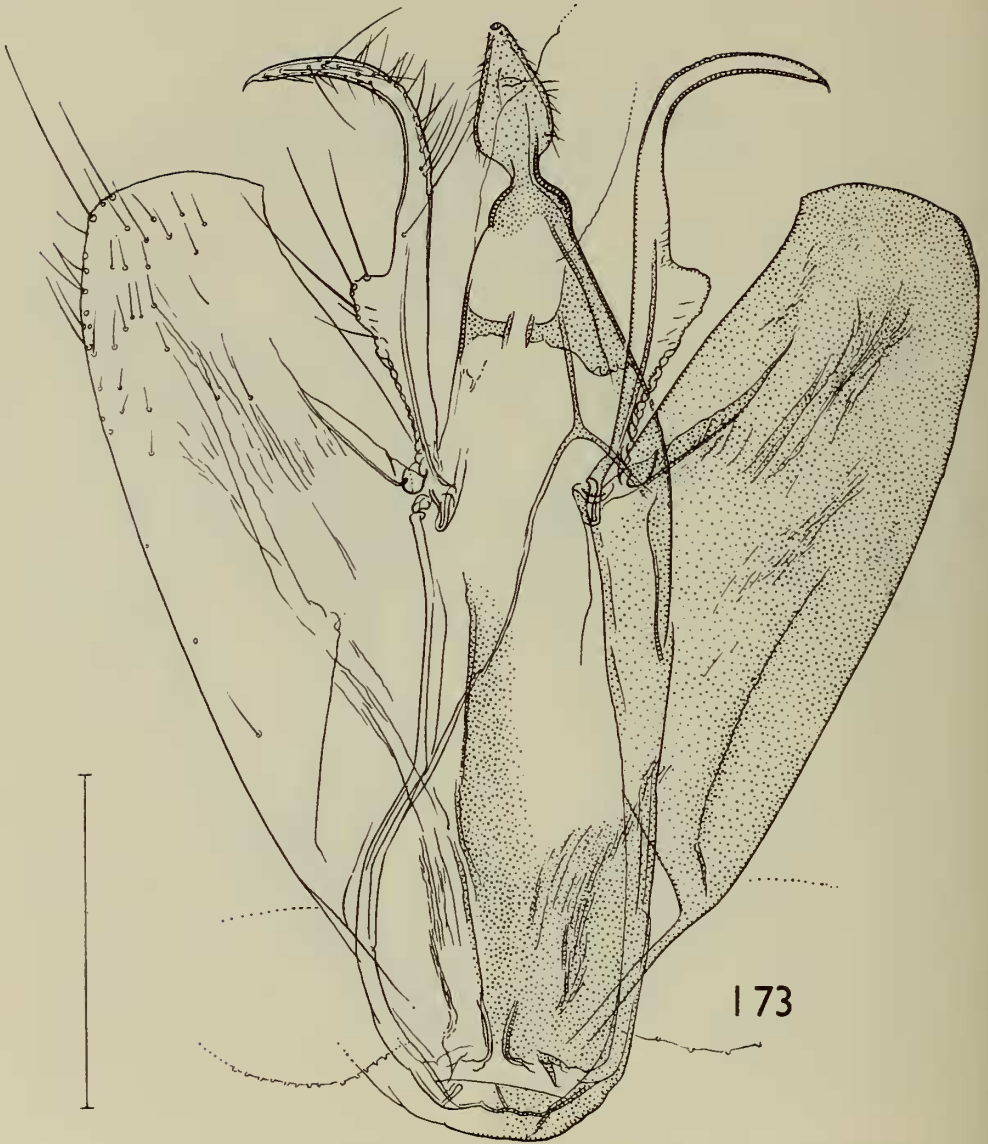




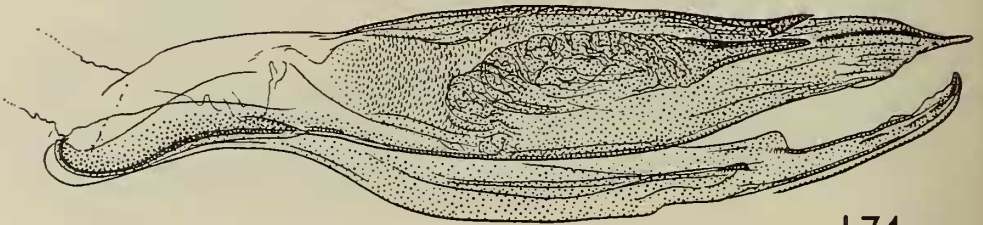
FIGS 169, 170. *Zamarada carcassoni*, genitalia (A.S.). 169, ♂; 170, aedeagus.



FIGS 171, 172. *Zamarada bernardii*, genitalia (M.L.). 171, ♂; 172, aedeagus.

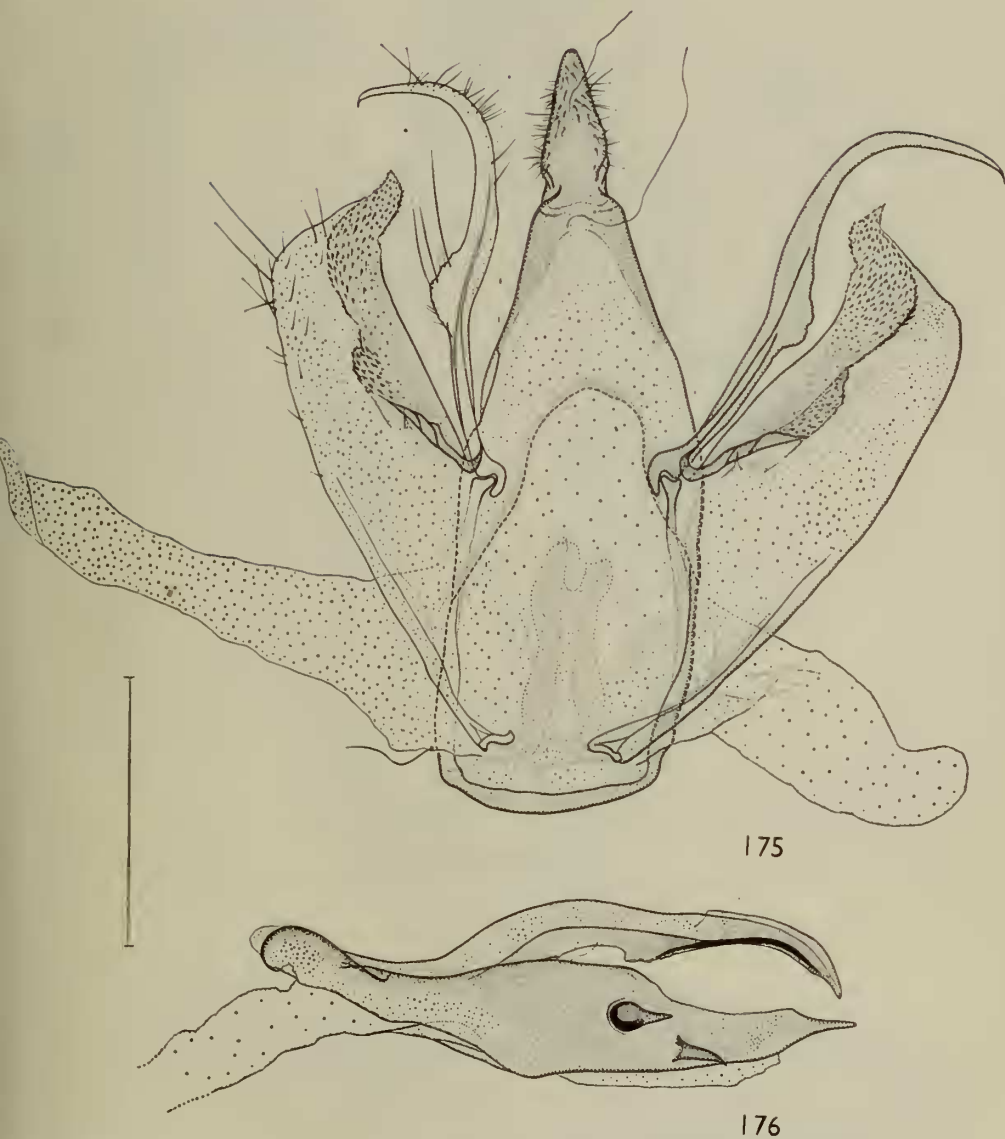


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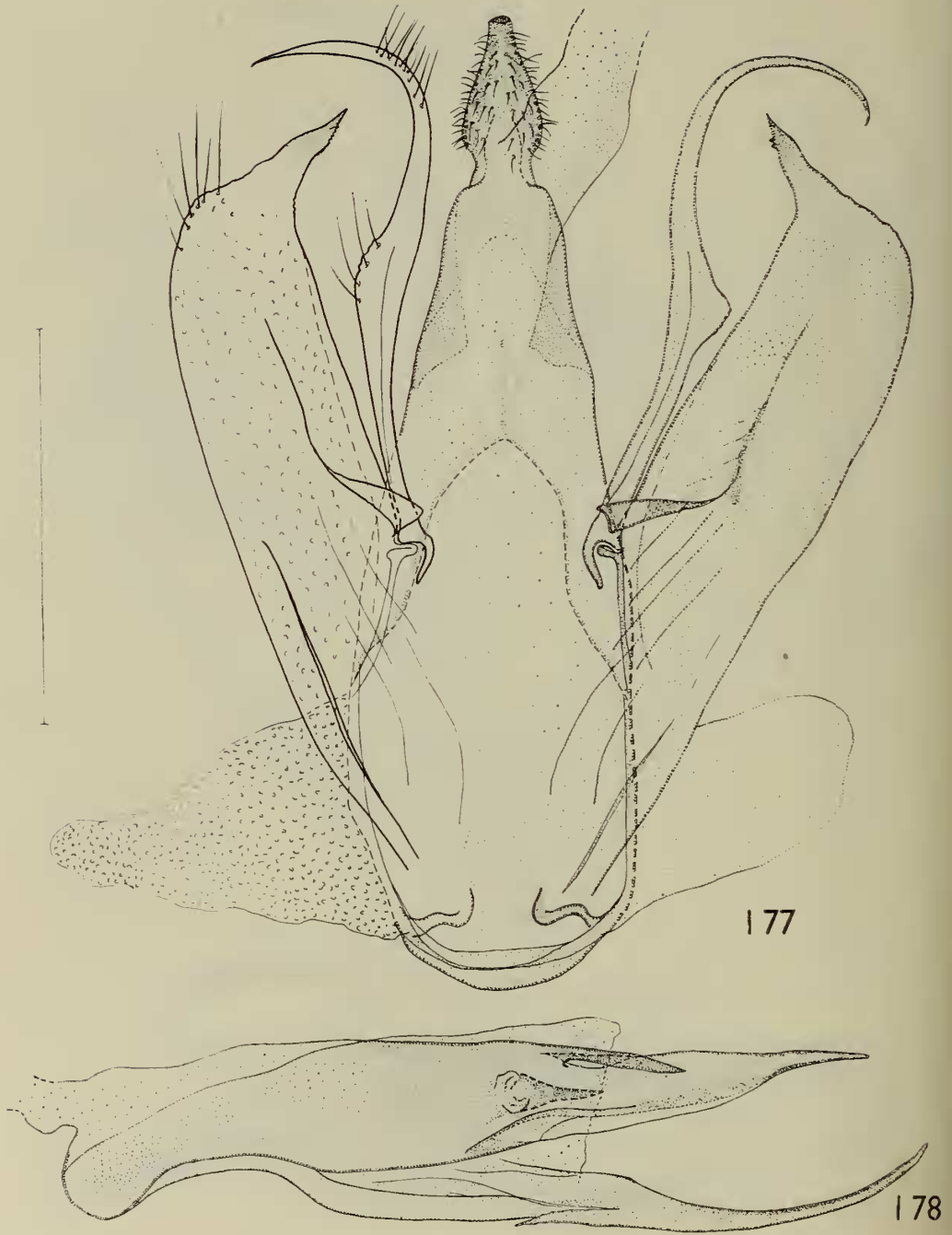
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FIGS 173, 174. *Zamarada antimima*, genitalia (A.S.). 173, ♂; 174, aedeagus.



FIGS 175, 176. *Zamarada strigilecula*, genitalia (M.L.). 175, ♂; 176, aedeagus.

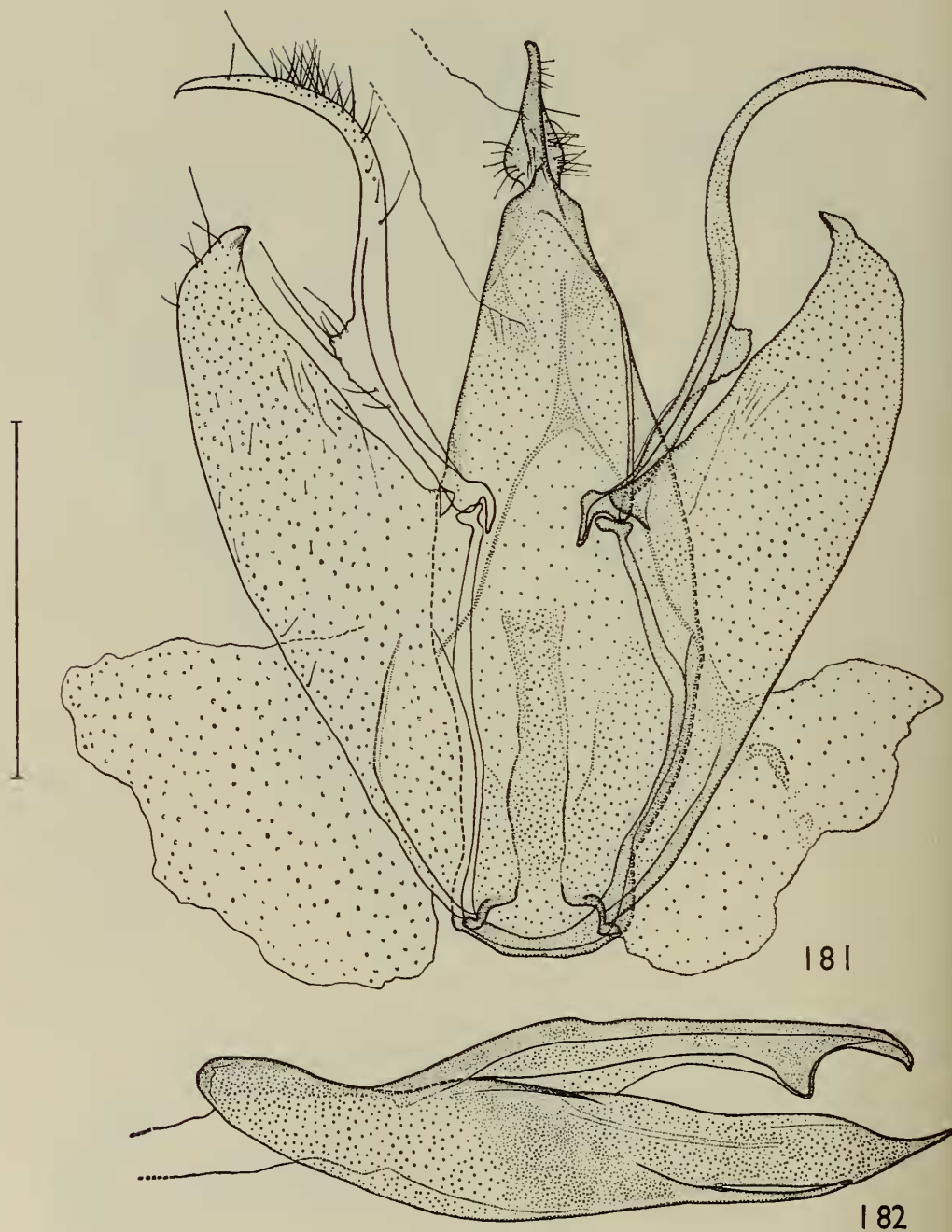




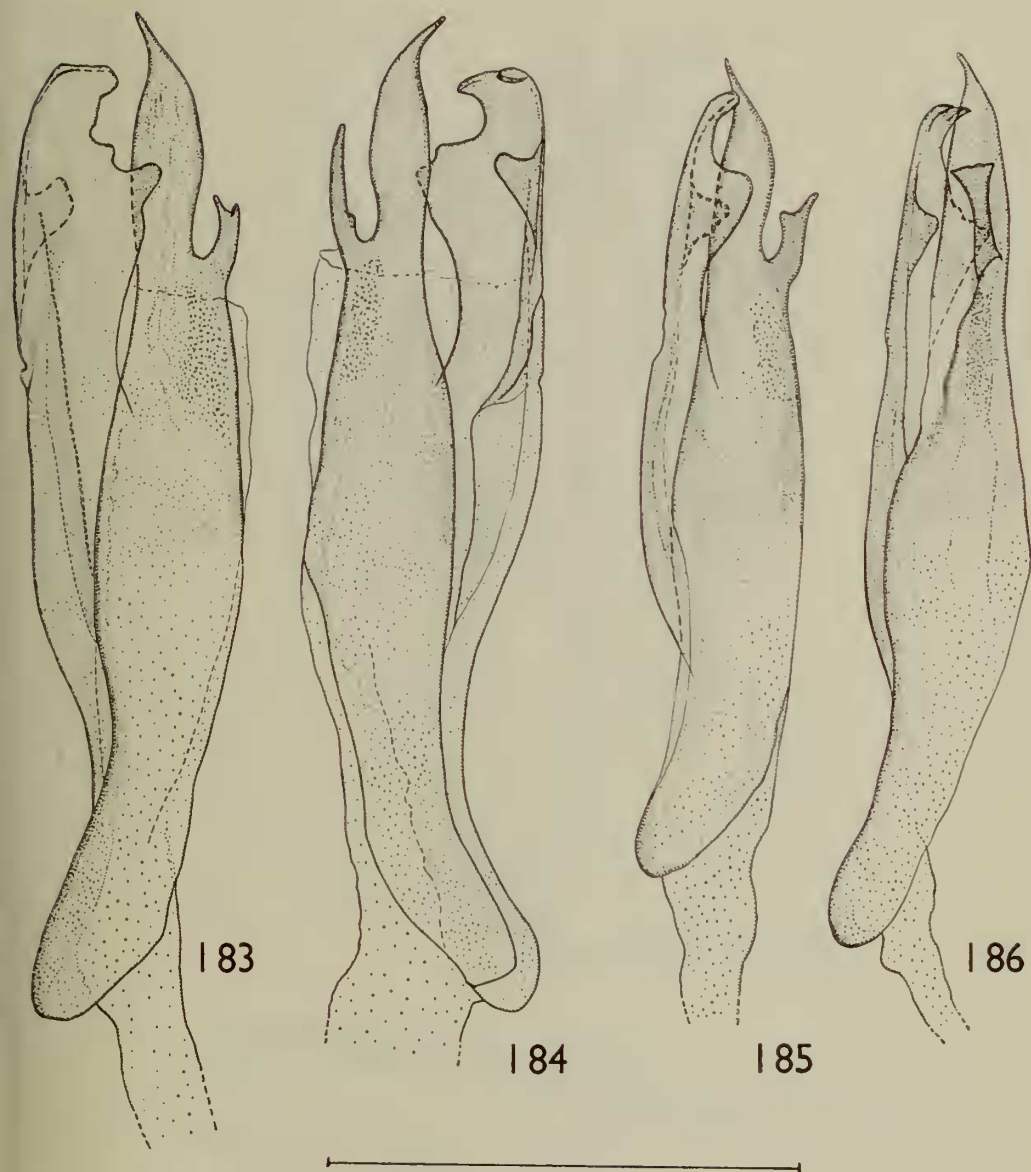
FIGS 177, 178. *Zamarada ferruginata*, genitalia (M.L.). 177, ♂; 178, aedeagus.



FIGS 179, 180. *Zamarada arguta*, genitalia (M.L.). 179, ♂; 180, aedeagus.

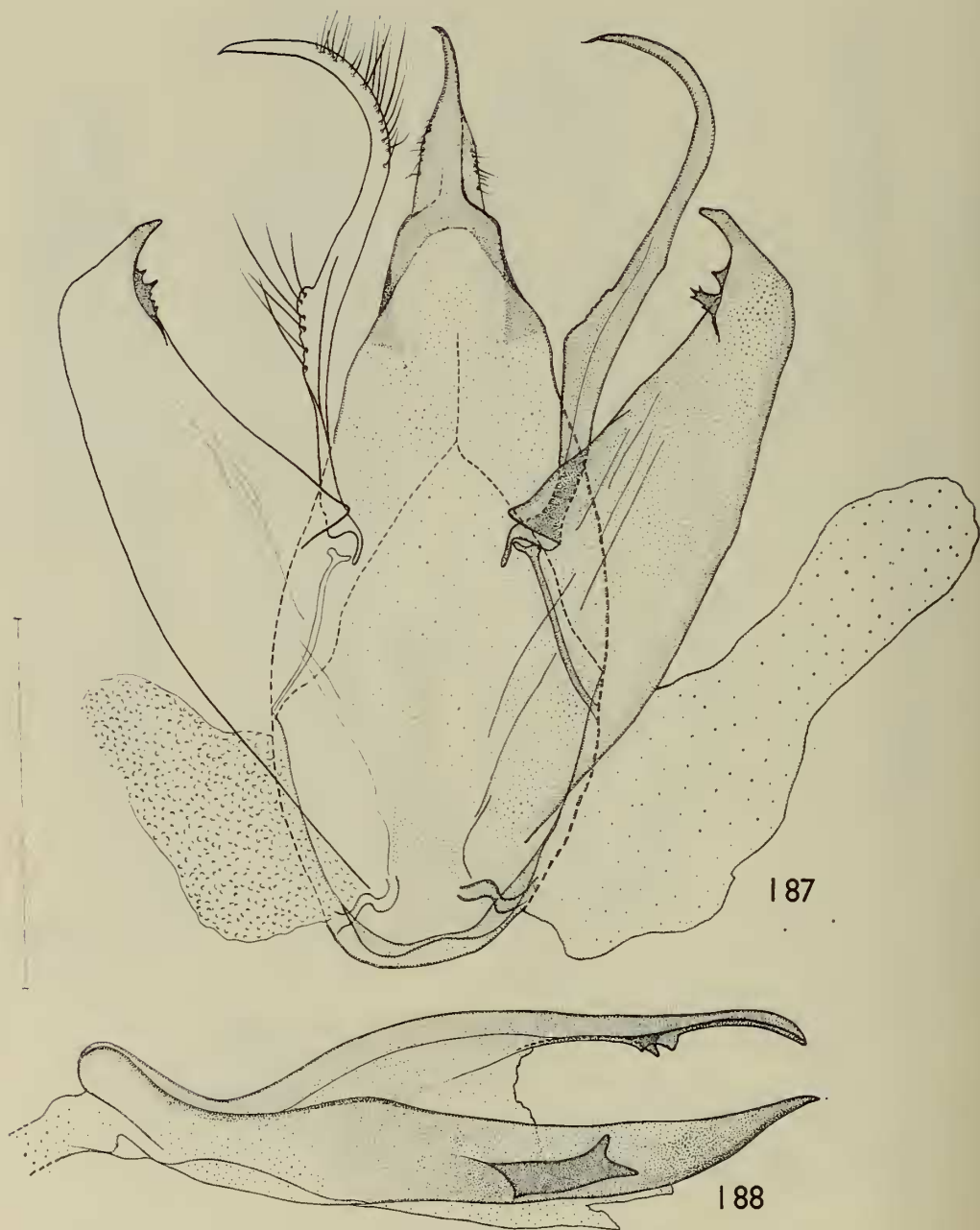


FIGS 181, 182. *Zamarada dentigera dentigera*, genitalia, Cameroun (M.I.).  
181, ♂; 182, aedeagus.



FIGS 183-186. *Zamarada*, genitalia (M.L.). 183-185, *dentigera dentigera*. 183, aedeagus, Nigeria; 184, aedeagus, Ivory Coast; 185, aedeagus, Malawi. 186, *dentigera stenotes*, aedeagus.

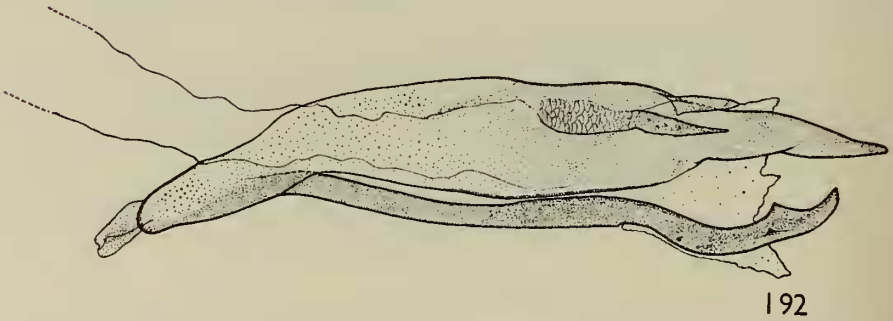
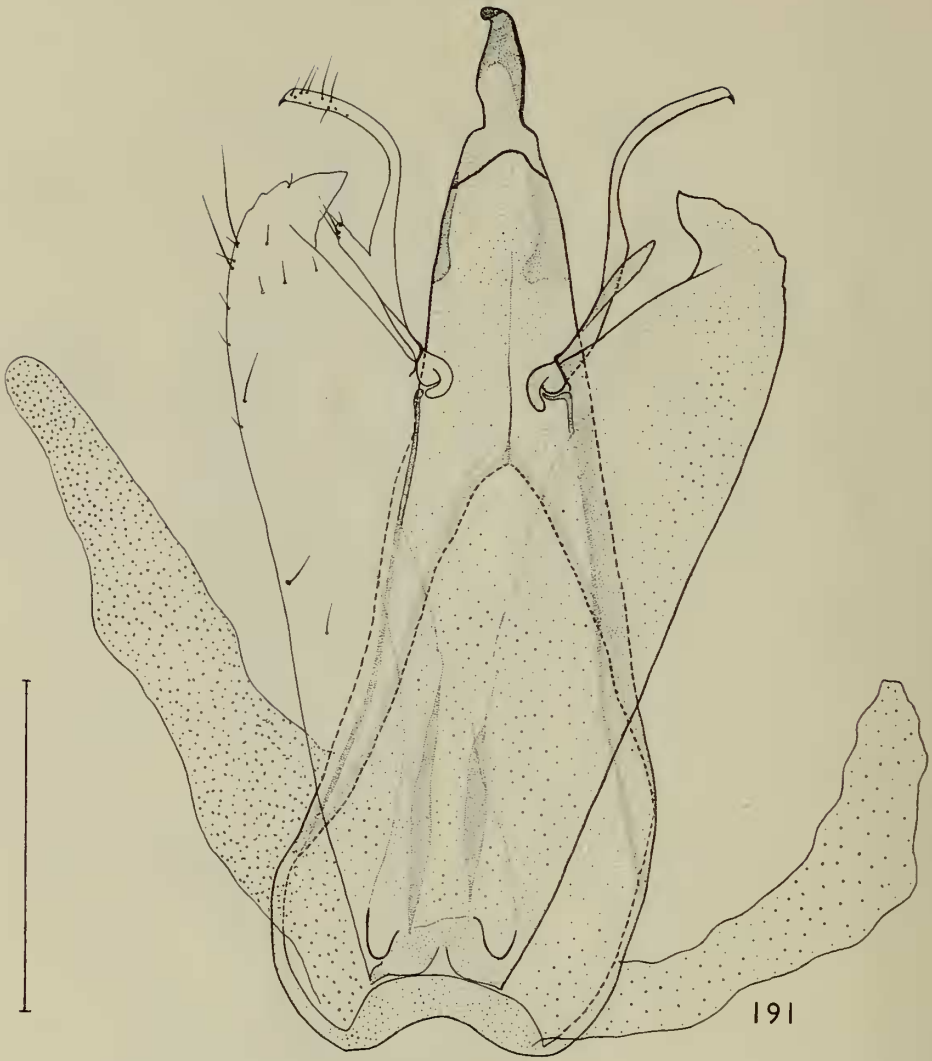




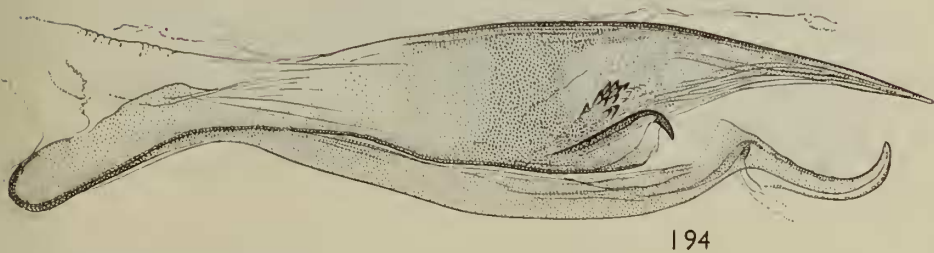
FIGS 187, 188. *Zamarada chrysopa*, genitalia (M.L.). 187, ♂; 188, aedeagus.



FIGS 189, 190. *Zamarada fibulata*, genitalia (M.L.). 189, ♂; 190, aedeagus.

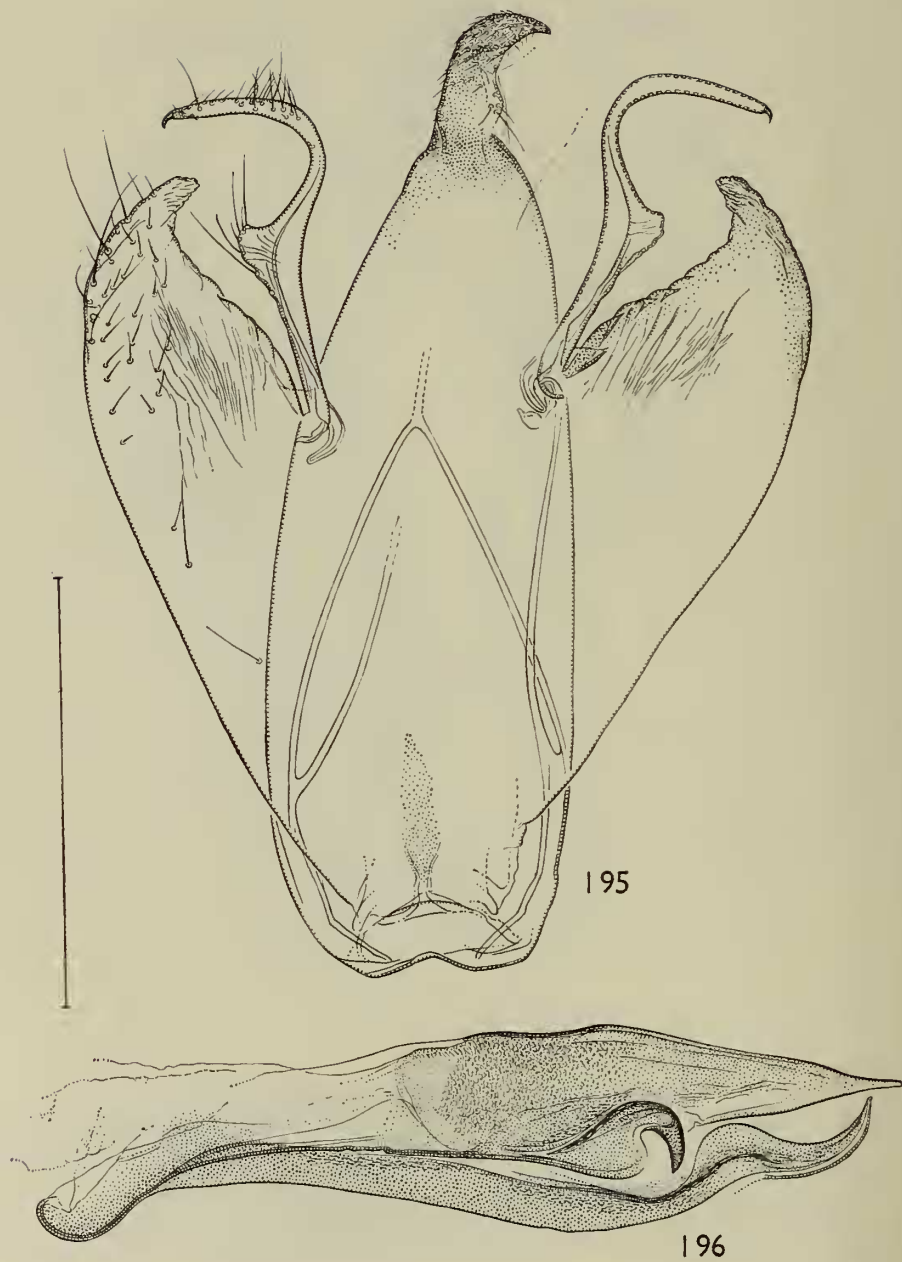


FIGS 191, 192. *Zamarada urania*, genitalia (M.L.). 191, ♂; 192, aedeagus

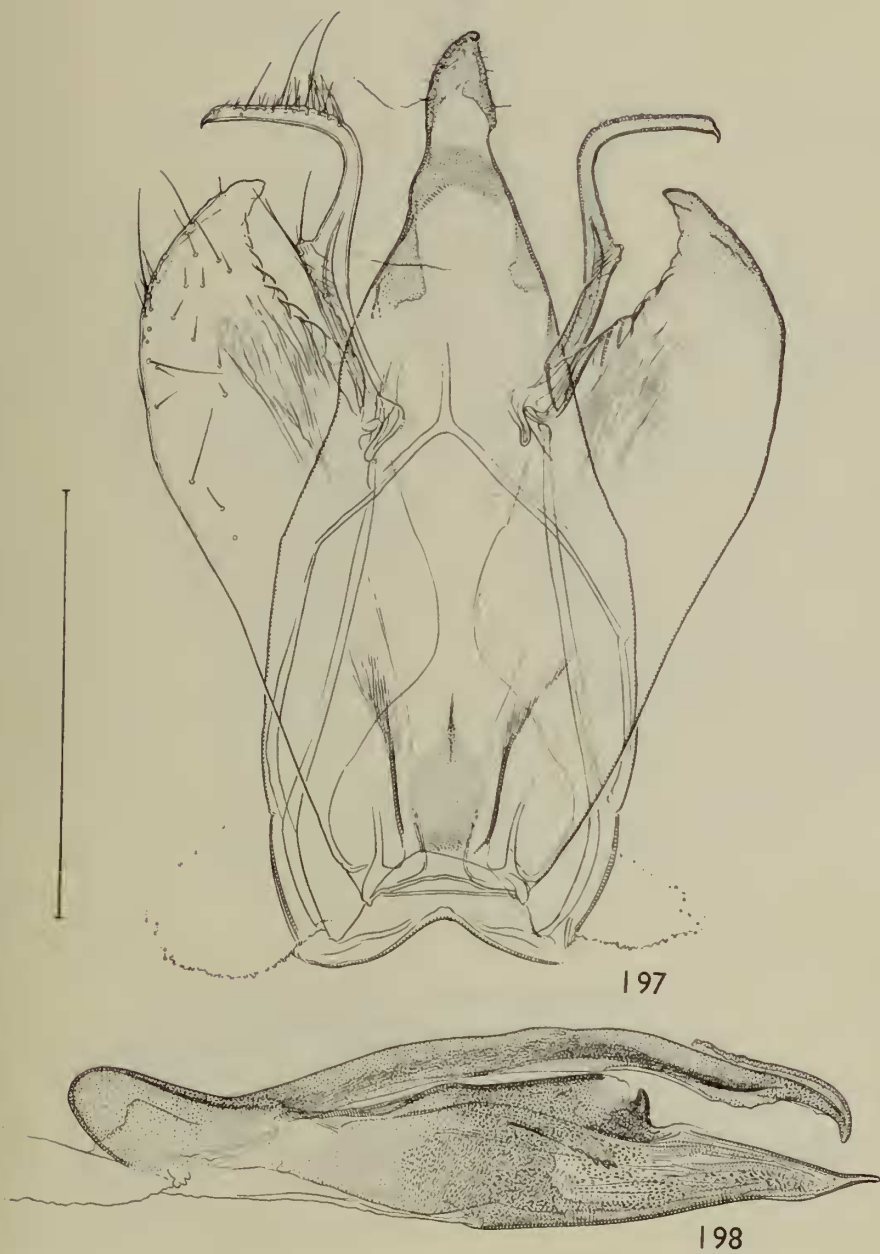


FIGS 193, 194. *Zamarada melanopyga*, genitalia (A.S.). 193, ♂; 194, aedeagus.

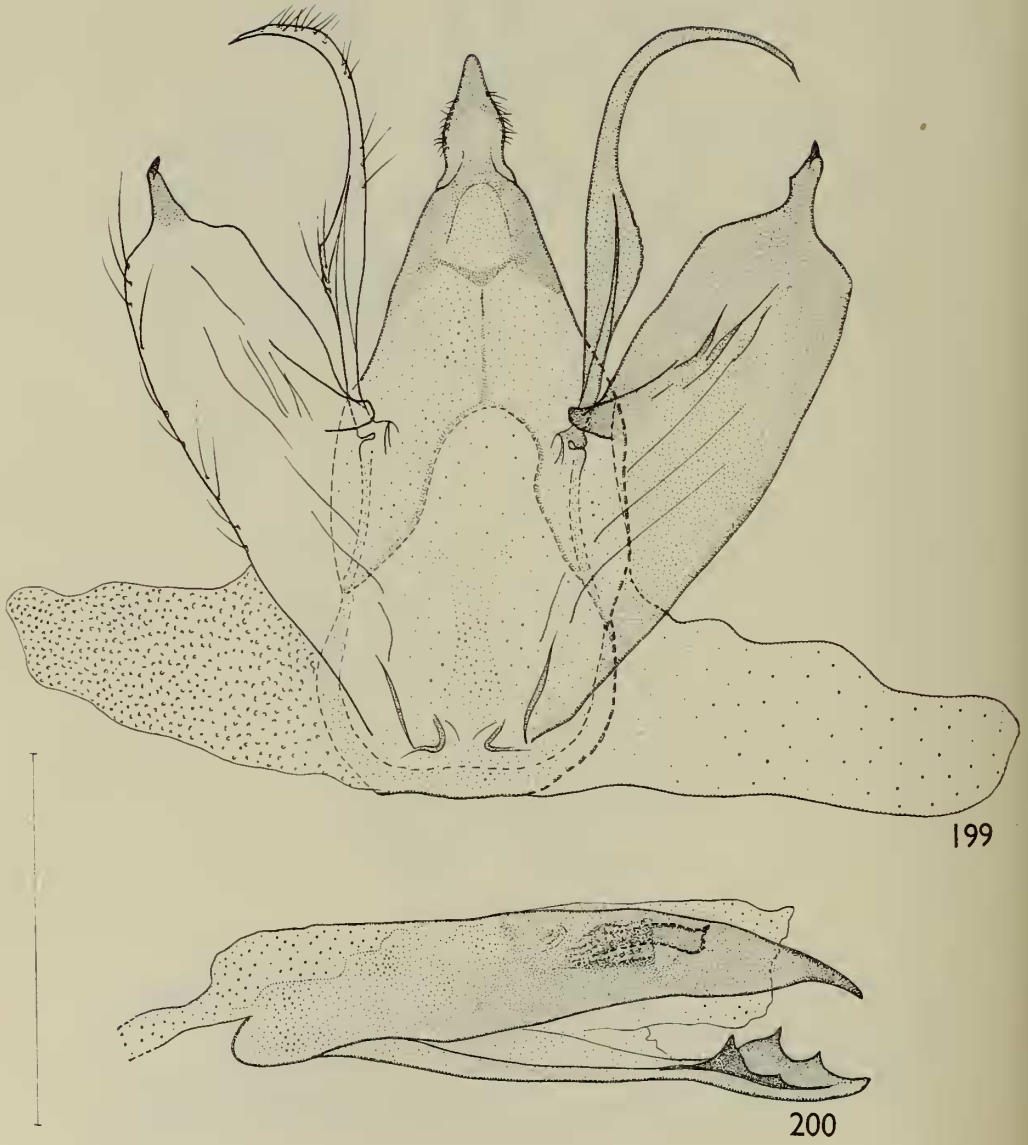




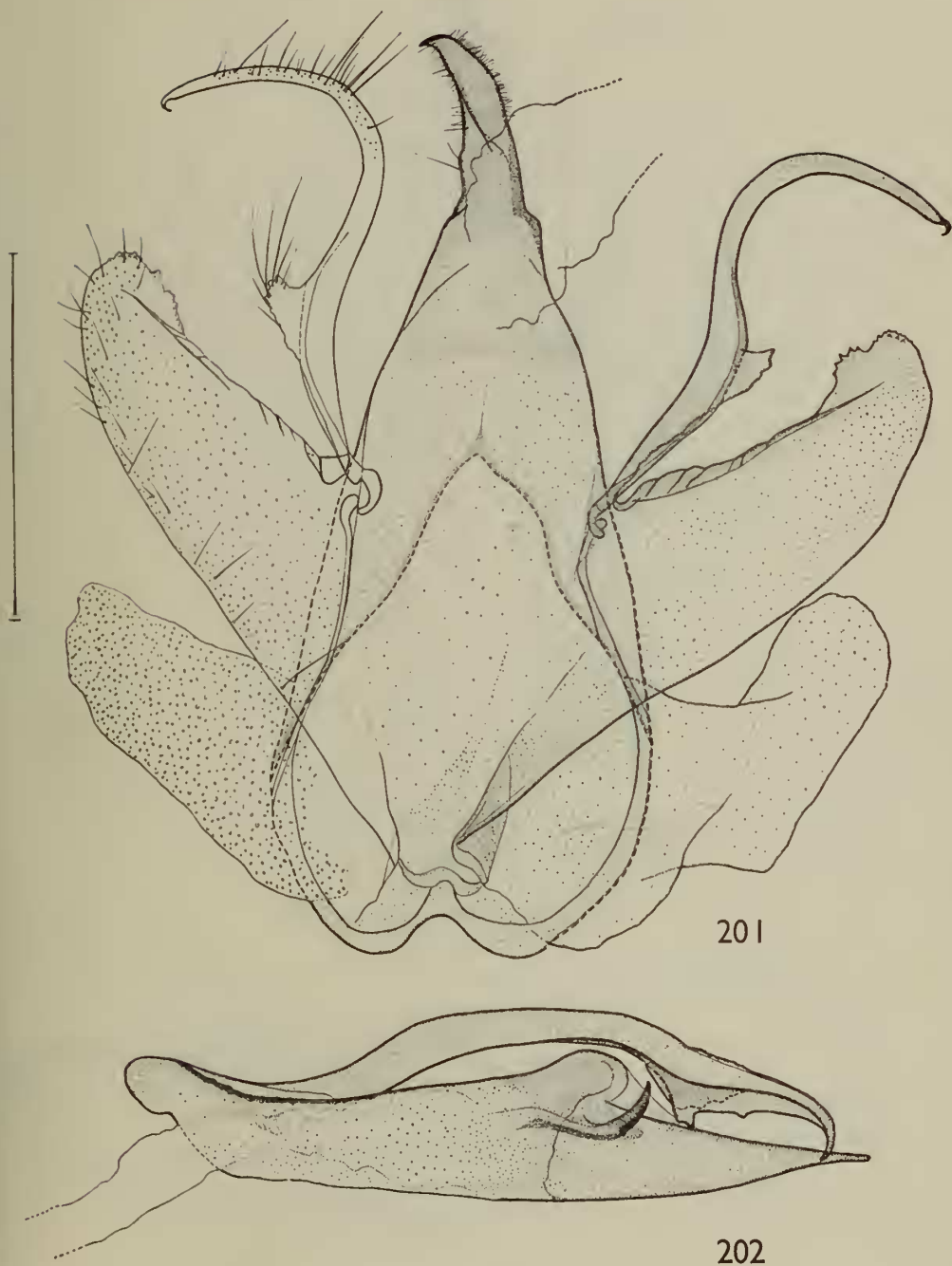
FIGS 195, 196. *Zamarada ostracodes*, genitalia (A.S.). 195, ♂; 196, aedeagus.



FIGS 197, 198. *Zamarada aglae*, genitalia (J.A.). 197, ♂; 198, aedeagus.

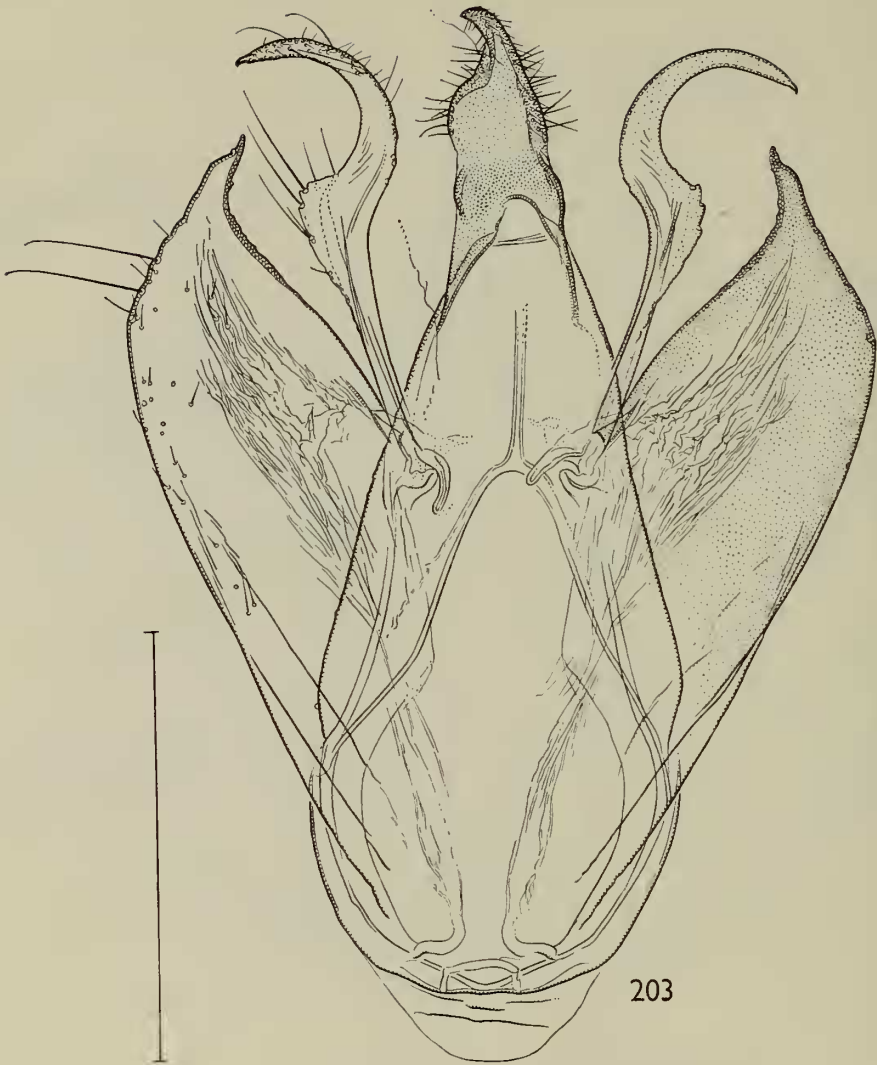


FIGS 199, 200. *Zamarada ariste*, genitalia (M.I.). 199, ♂; 200, aedeagus.

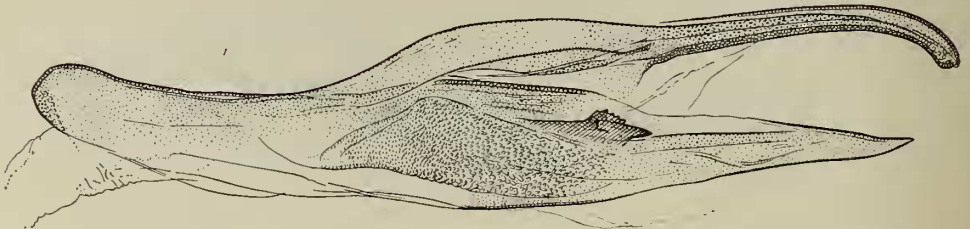


FIGS 201, 202. *Zamarada phoenopasta*, genitalia (M.L.). 201, ♂; 202, aedeagus.





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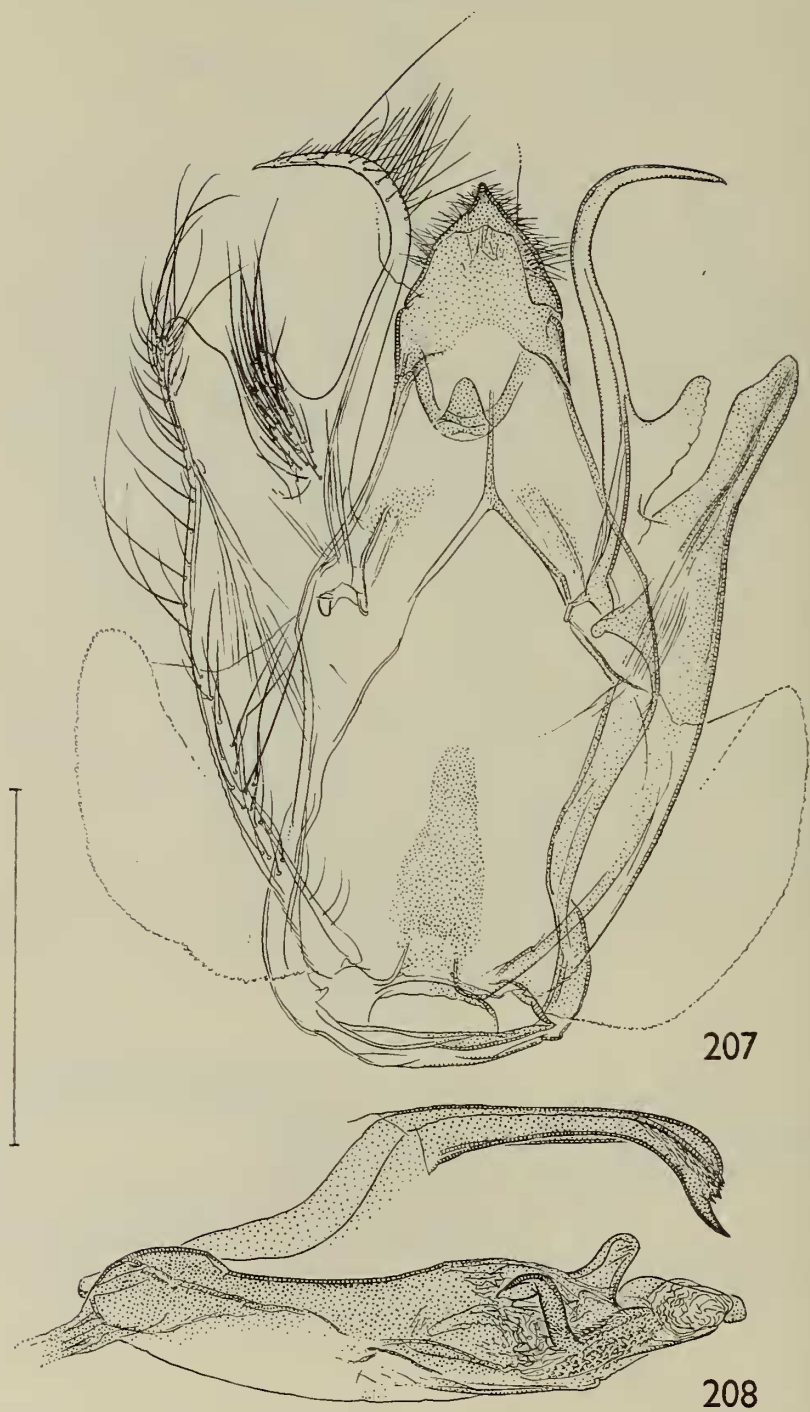


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FIGS 203, 204. *Zamarada cautela*, genitalia (A.S.). 203, ♂, 204 aedeagus.



FIGS 205, 206. *Zamarada miranda*, genitalia (M.L.). 205, ♂; 206, aedeagus.

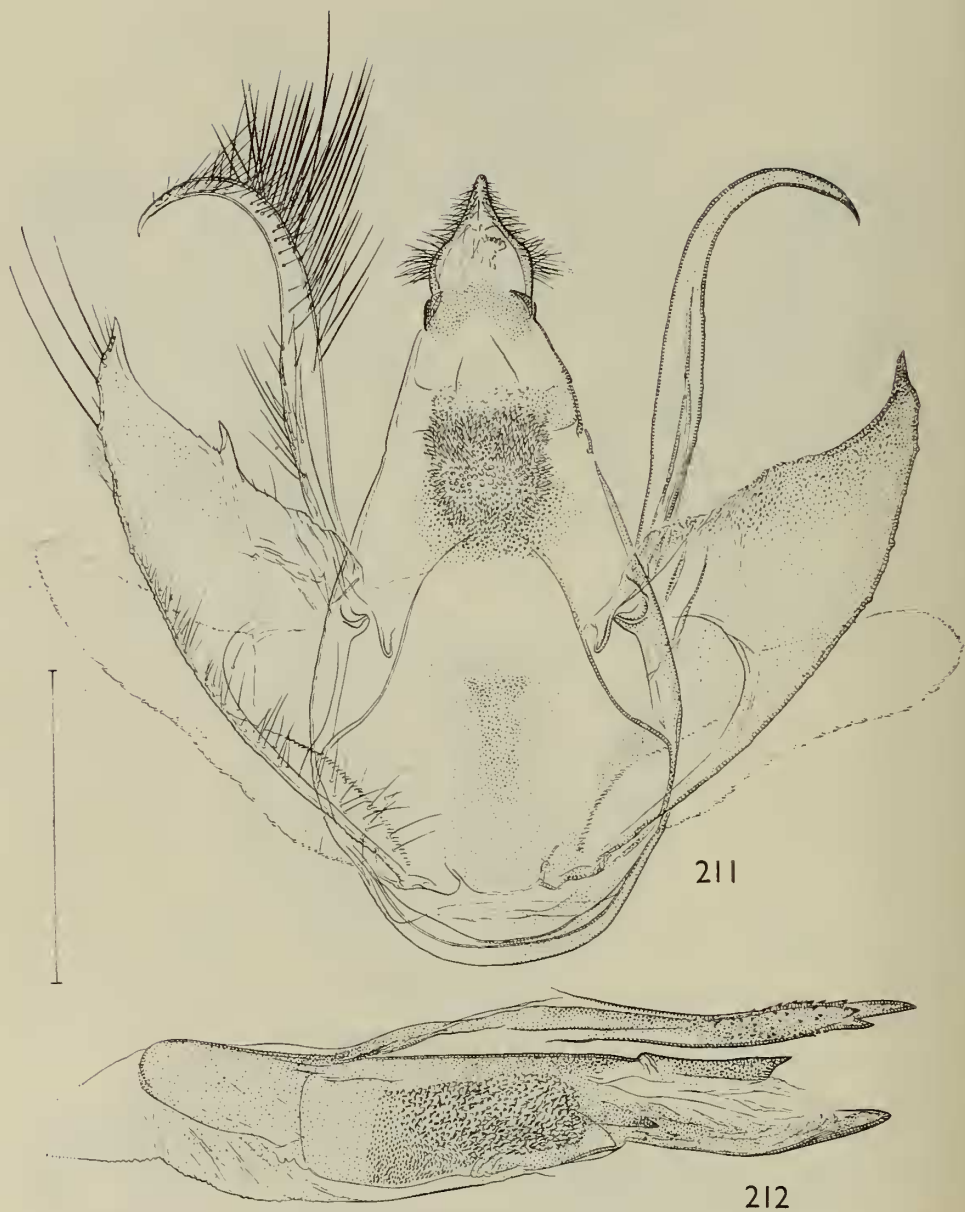


FIGS 207, 208. *Zamarada viettei*, genitalia (A.S.). 207, ♂; 208, aedeagus.

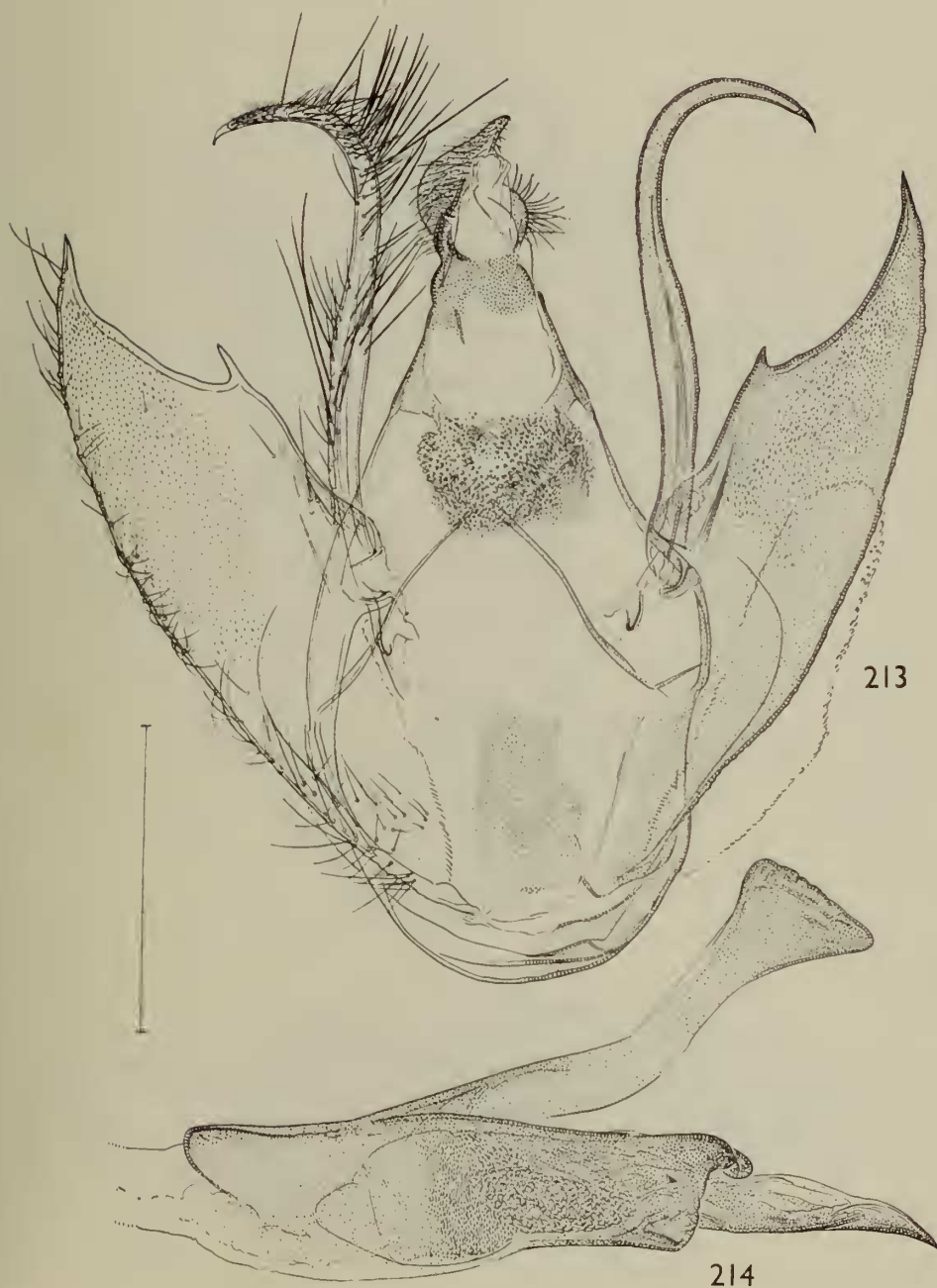


FIGS 209, 210. *Zamarada cepa*, genitalia (A.S.). 209, ♂; 210, aedeagus.

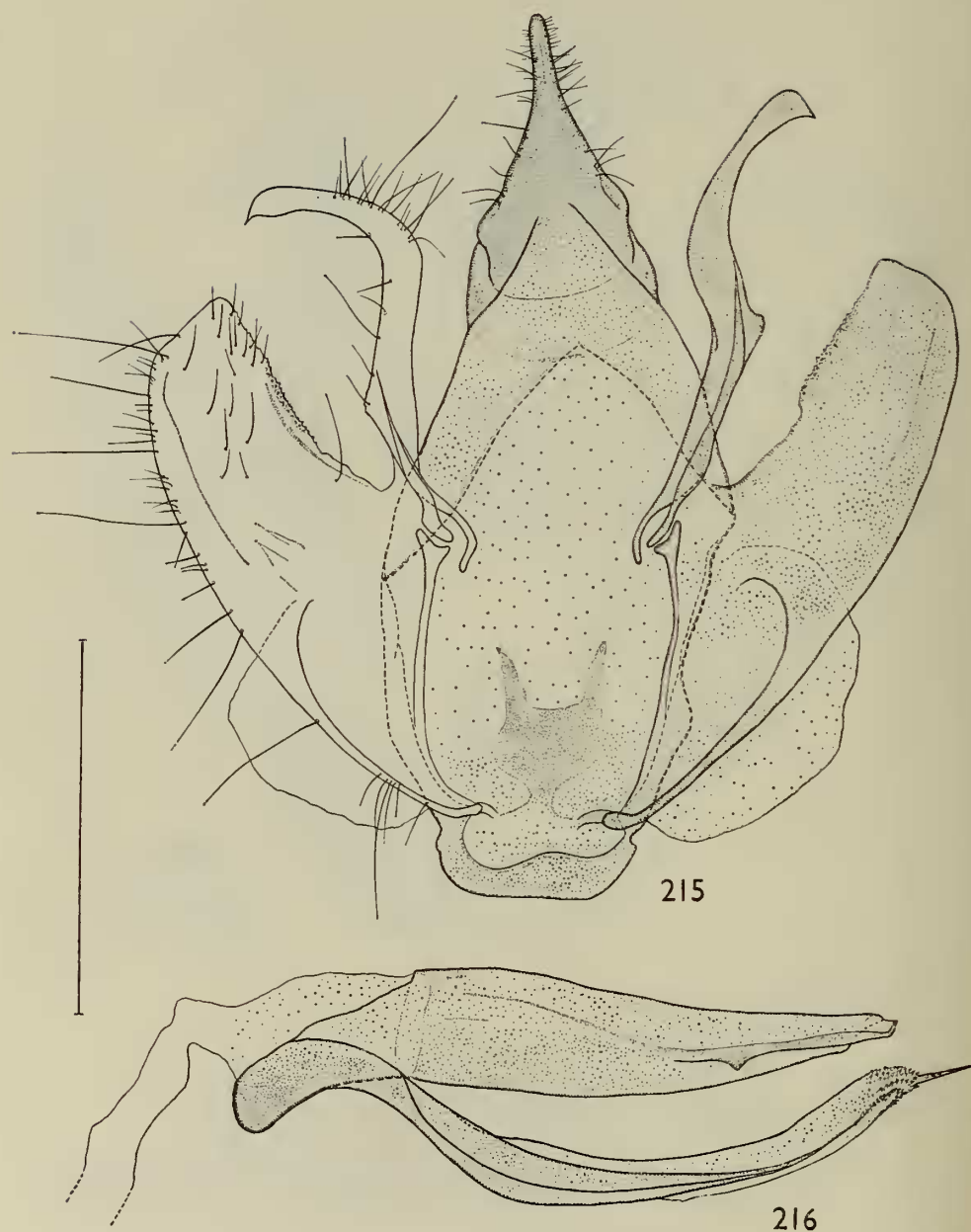




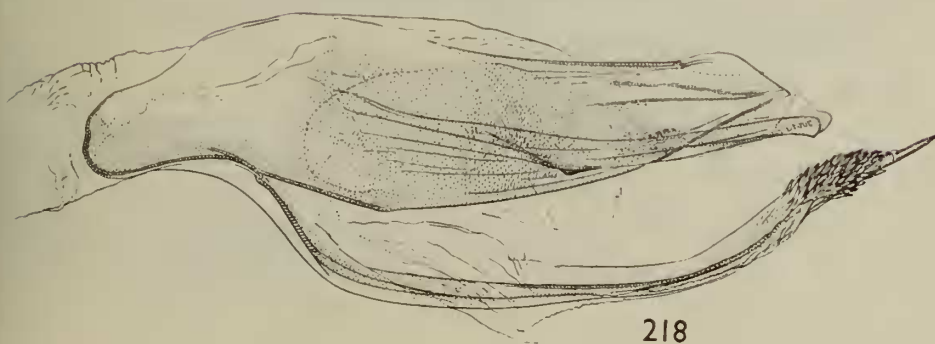
FIGS 211, 212. *Zamarada xystra*, genitalia (A.S.). 211, ♂; 212, aedeagus.



FIGS 213, 214. *Zamarada similis*, genitalia (A.S.). 213, ♂, 214, aedeagus.

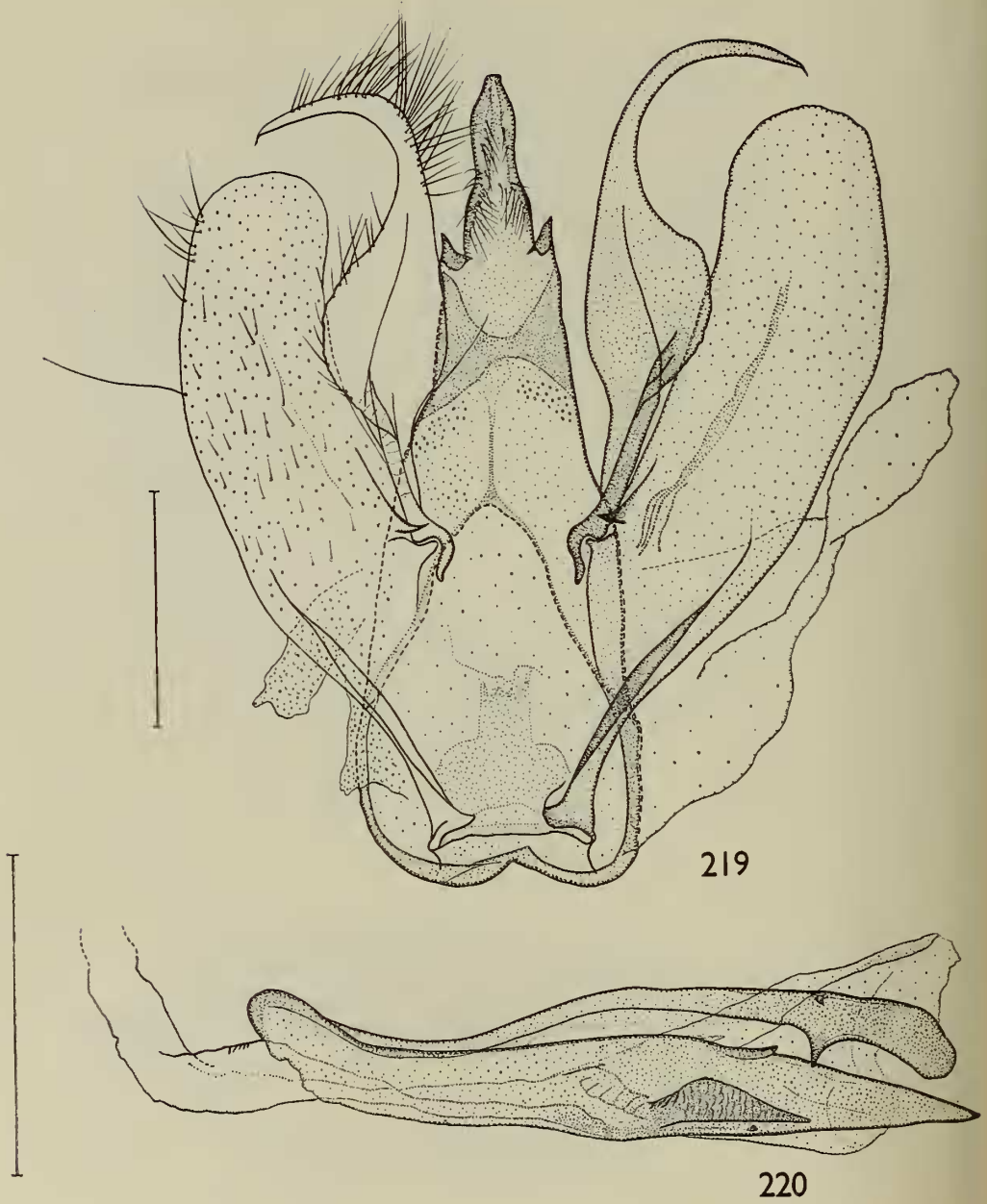


FIGS 215, 216. *Zamarada ilaria*, genitalia (M.L.). 215, ♂; 216, aedeagus.

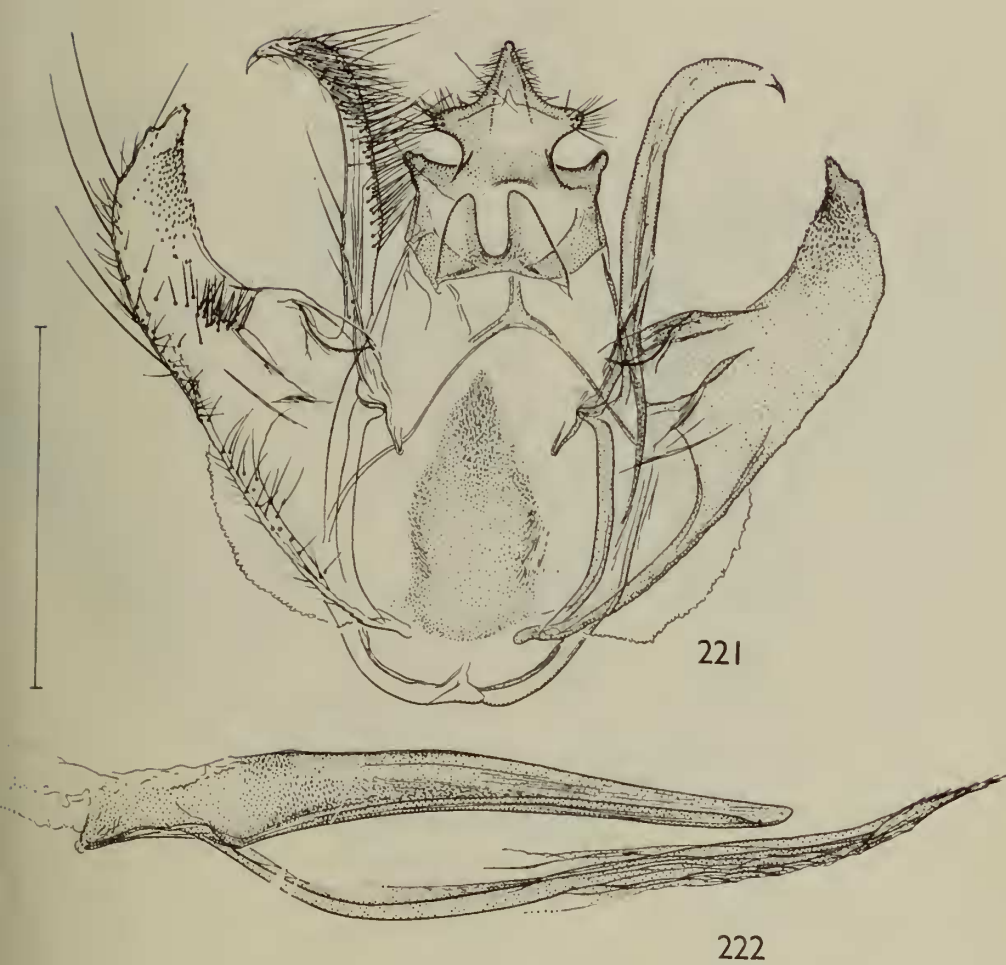


FIGS 217, 218. *Zamarada erato*, genitalia (A.S.). 217, ♂; 218, aedeagus.





FIGS 219, 220. *Zamarada gaedei*, genitalia (M.L.). 219, ♂; 220, aedeagus.



FIGS 221, 222. *Zamarada transvisaria*, genitalia (A.S.). 221, ♂; 222, aedeagus.

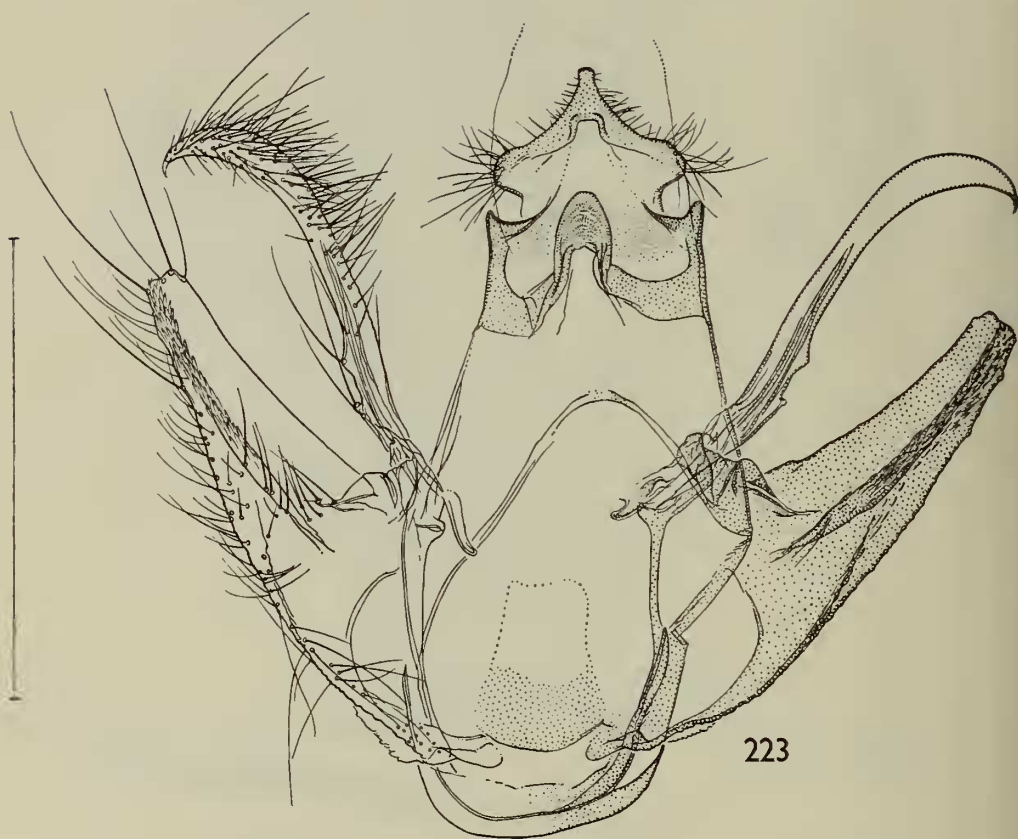
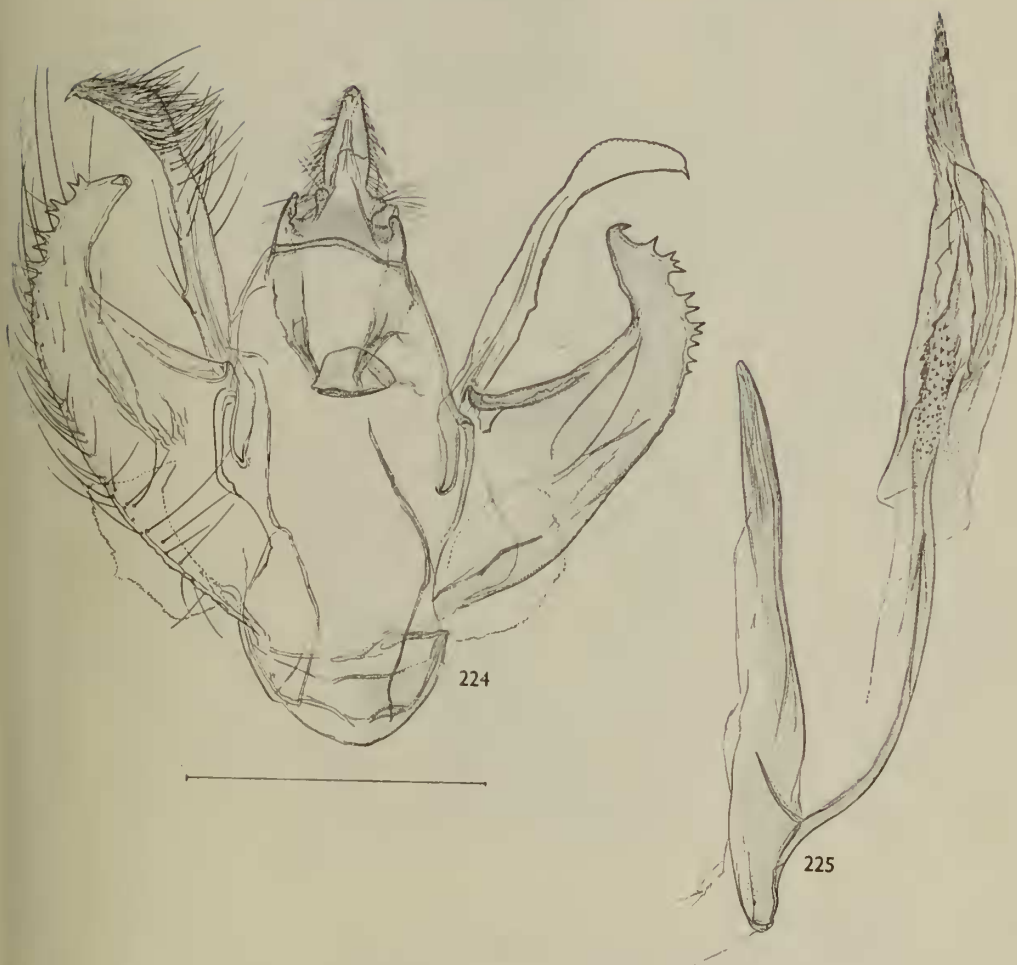
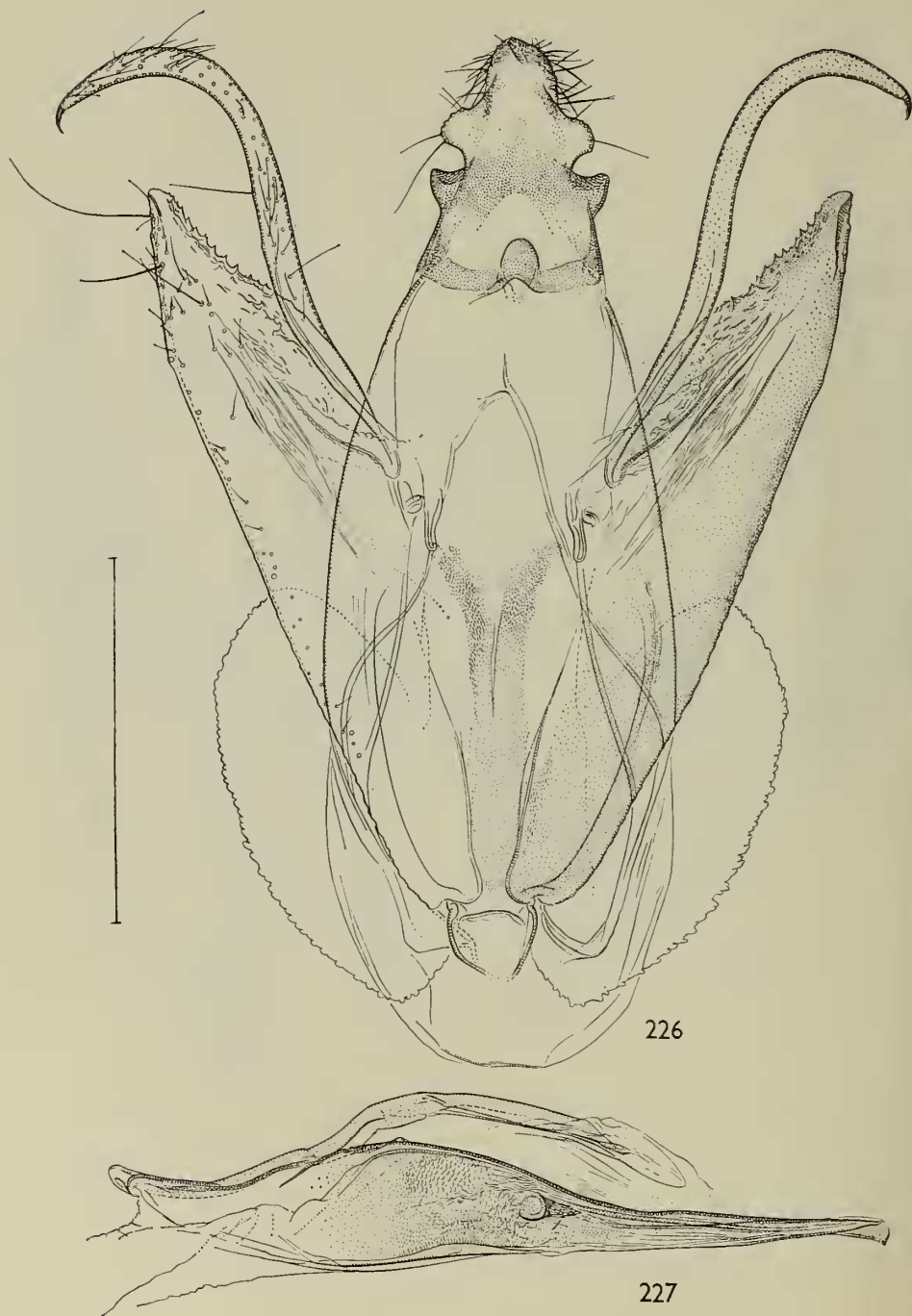


FIG. 223. *Zamarada amelga*, ♂ genitalia (A.S.).

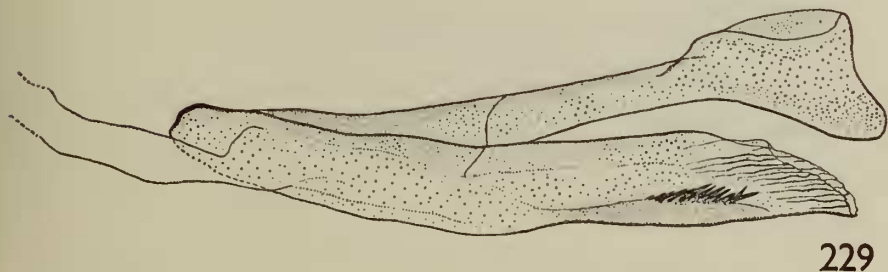
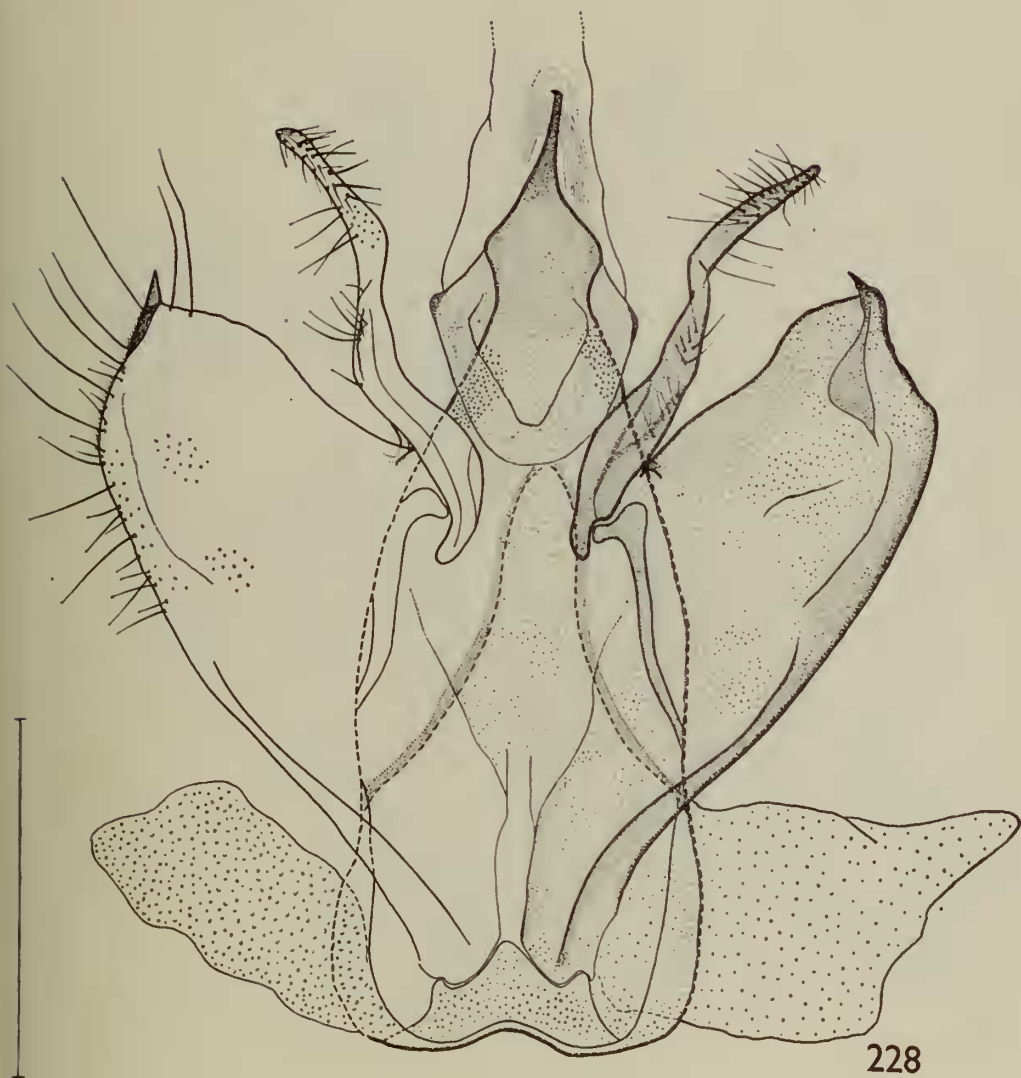


FIGS 224, 225. *Zamarada calypso*, genitalia (A.S.). 224, ♂; 225, aedeagus.

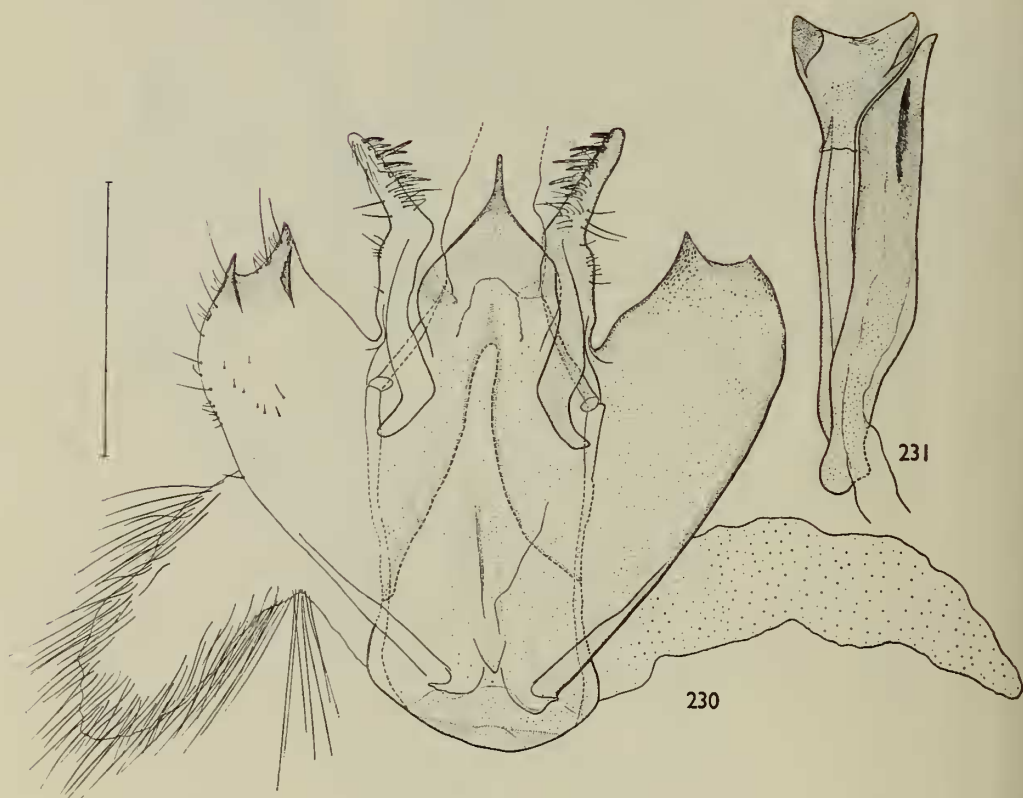




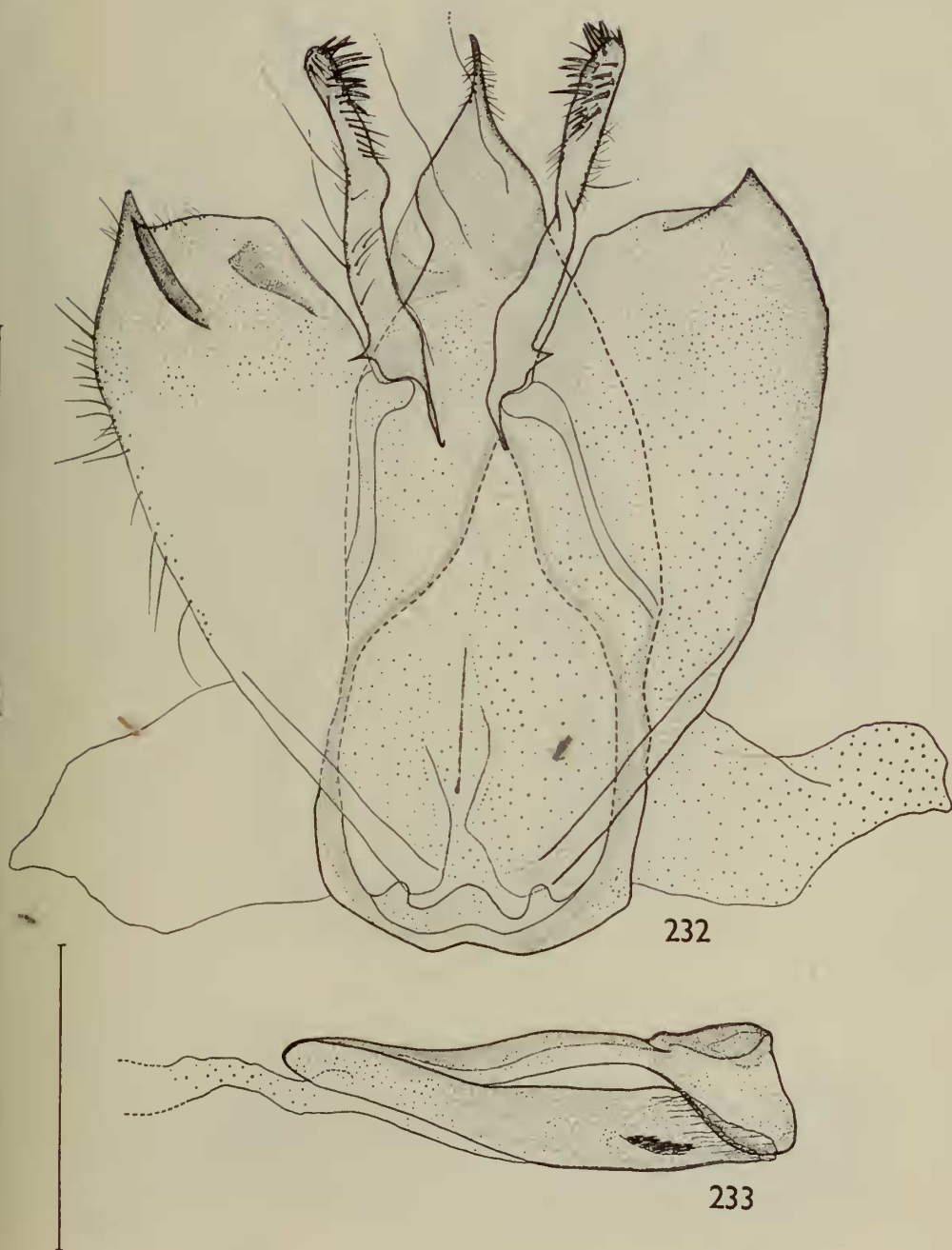
FIGS 226, 227. *Zamarada iobathra*, genitalia (A.S.). 226, ♂, 227, aedeagus.



FIGS 228, 229. *Zamarada bathyscaphes*, genitalia (M.L.). 228, ♂; 229, aedeagus.

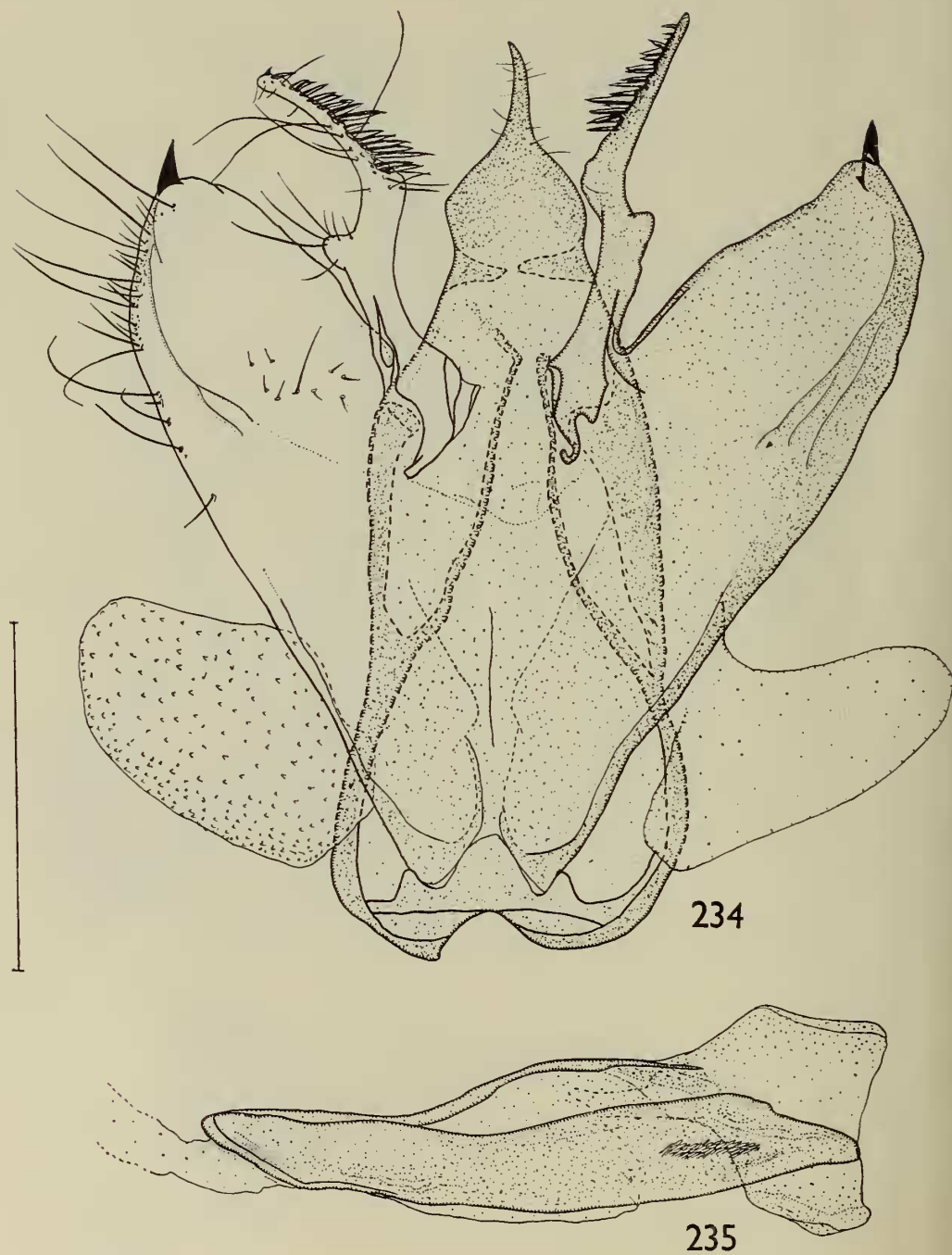


FIGS 230, 231. *Zamarada adiposata*, genitalia (M.L.). 230, ♂; 231, aedeagus.

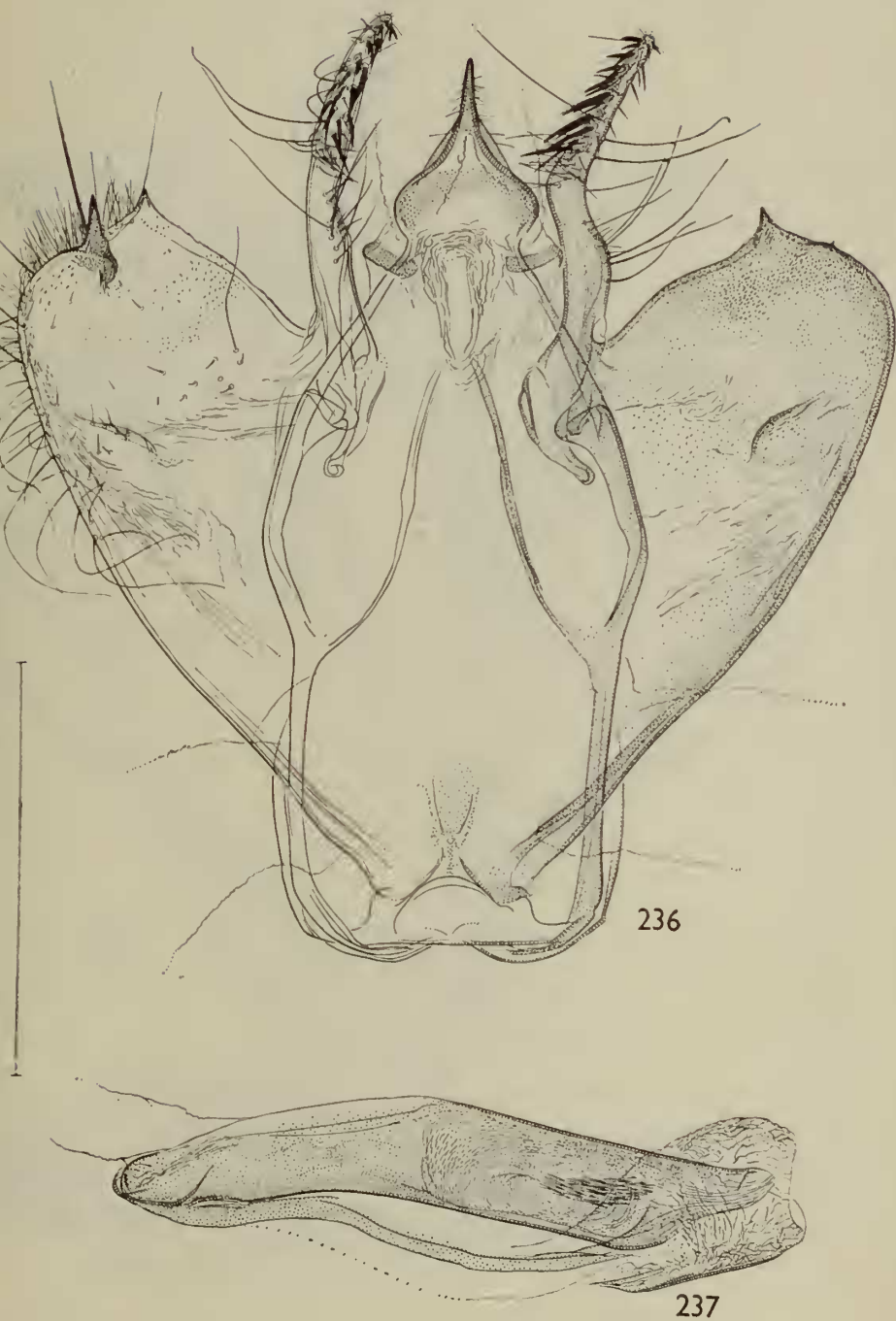


FIGS 232, 233. *Zamarada odontophora*, genitalia (M.I.). 232, ♂; 233, aedeagus.

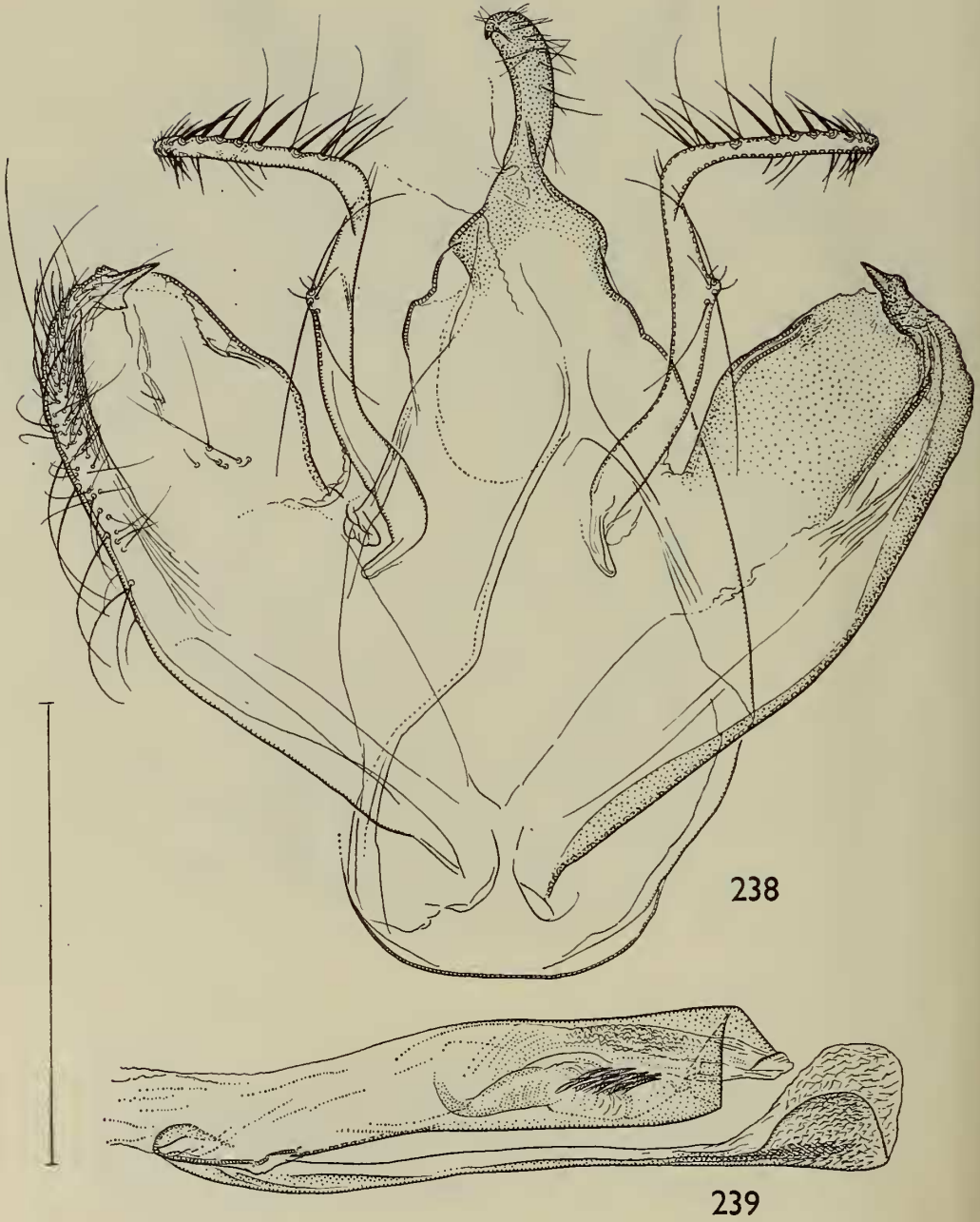




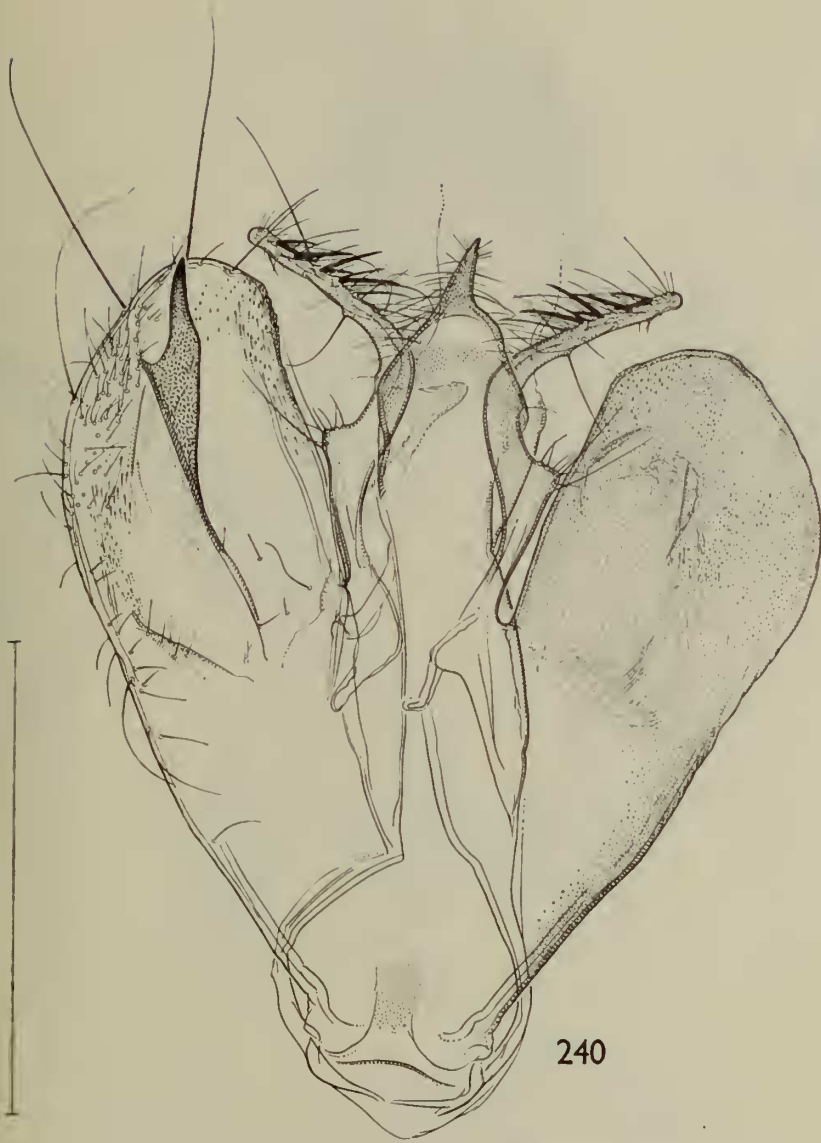
FIGS 234, 235. *Zamarada aequilumata*, genitalia (K.S.). 234, ♂; 235, aedeagus.



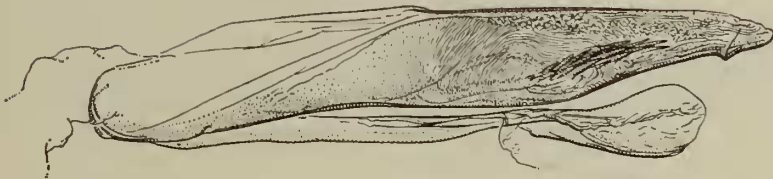
FIGS 236, 237. *Zamarada aclea*, genitalia (A.S.). 236, ♂; 237, aedeagus.



FIGS 238, 239. *Zamarada angustimargo*, genitalia (A.S.). 238, ♂; 239, aedeagus.



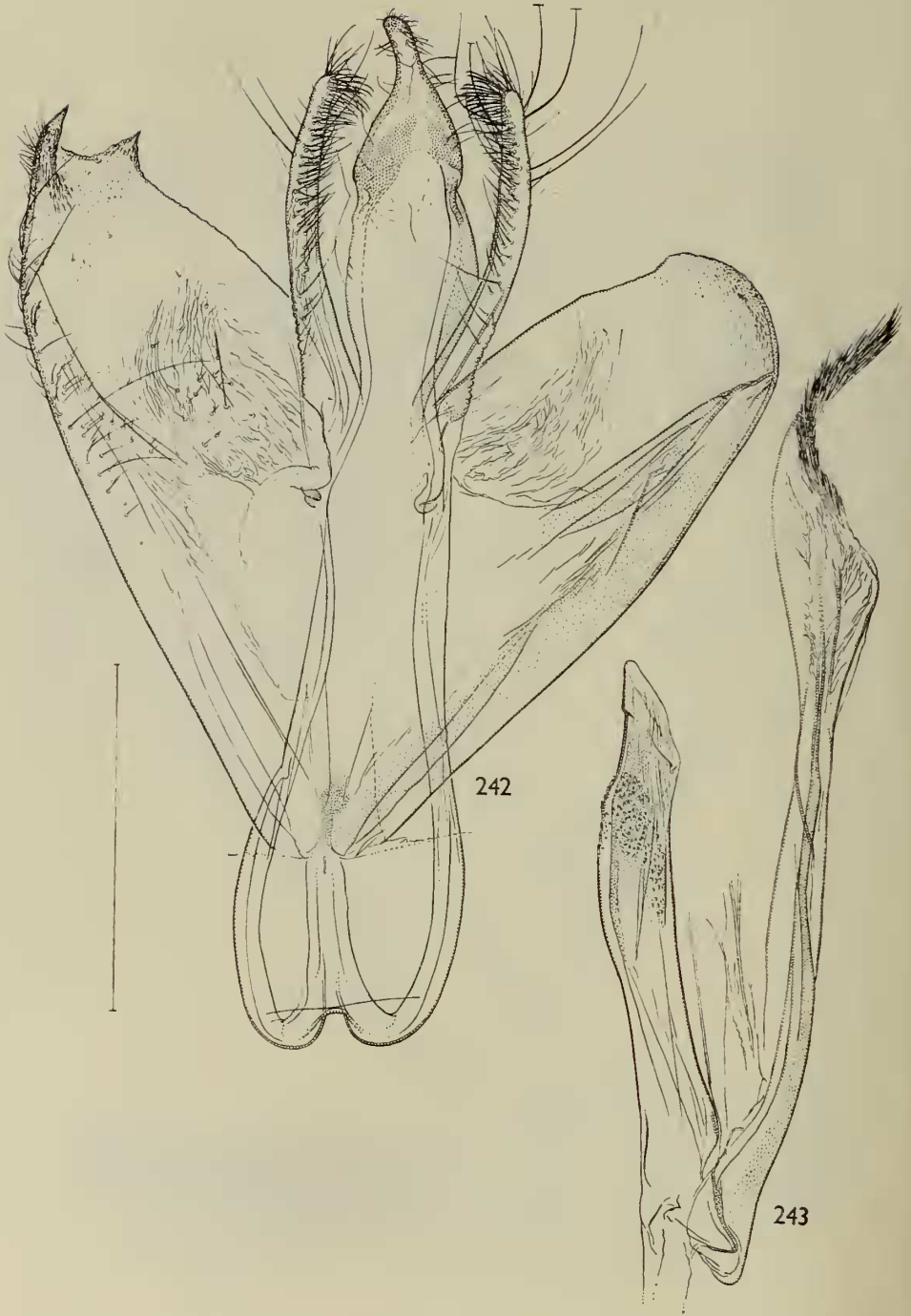
240



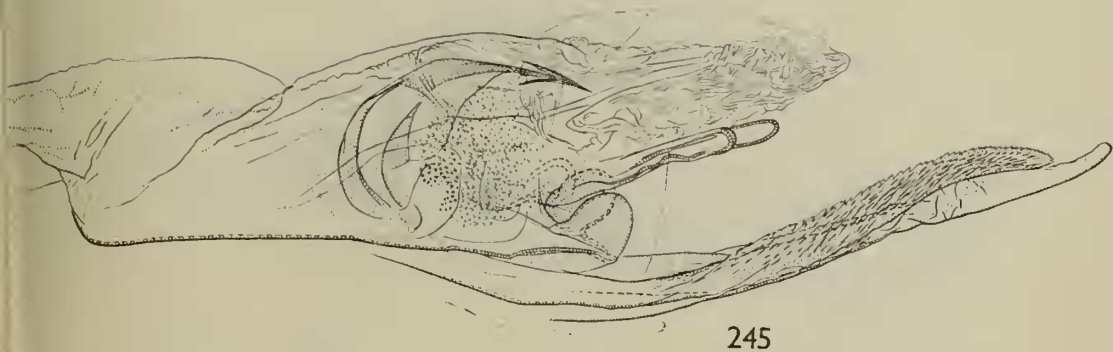
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FIGS 240, 241. *Zamarada psi*, genitalia (A.S.). 240, ♂; 241, aedeagus.

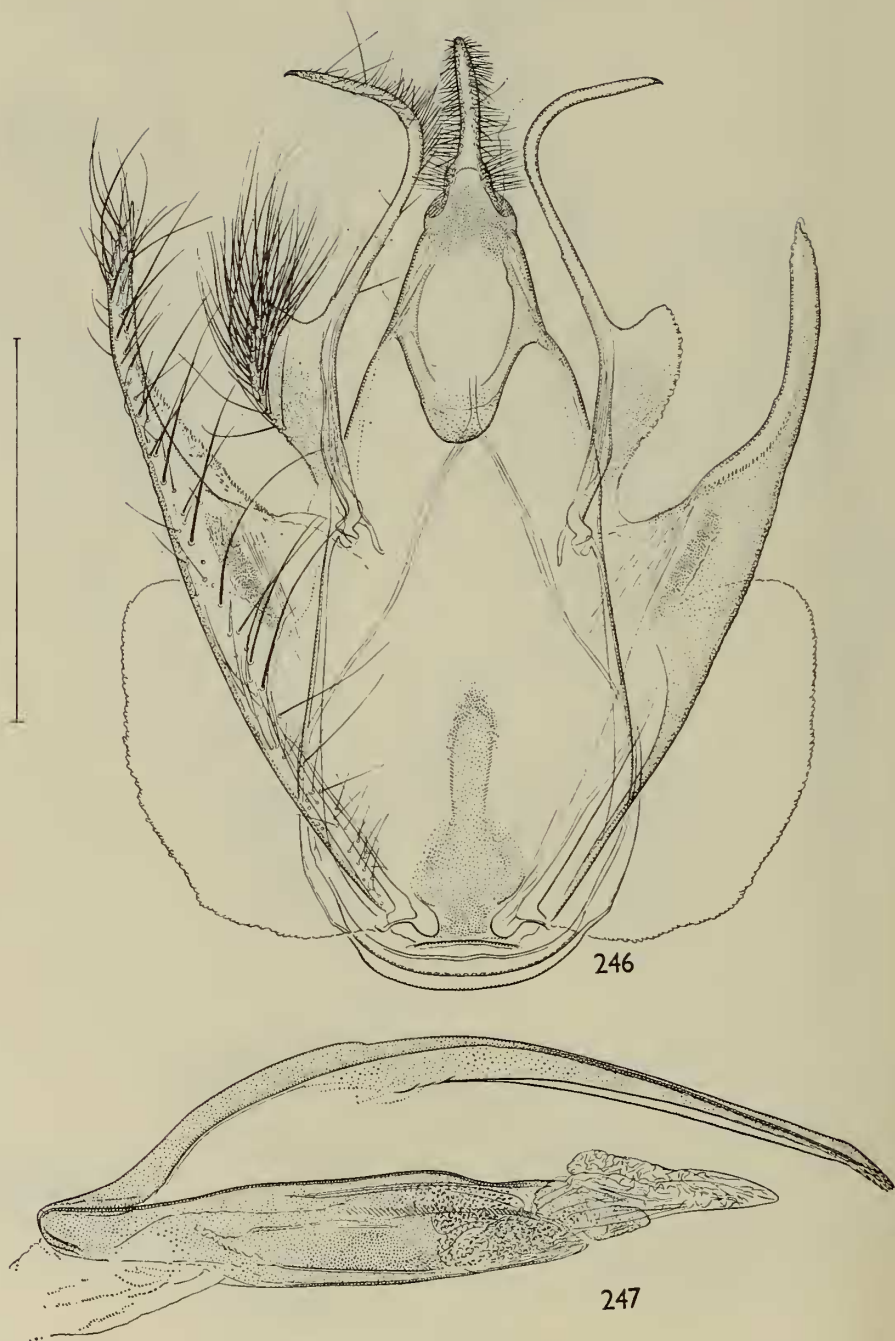




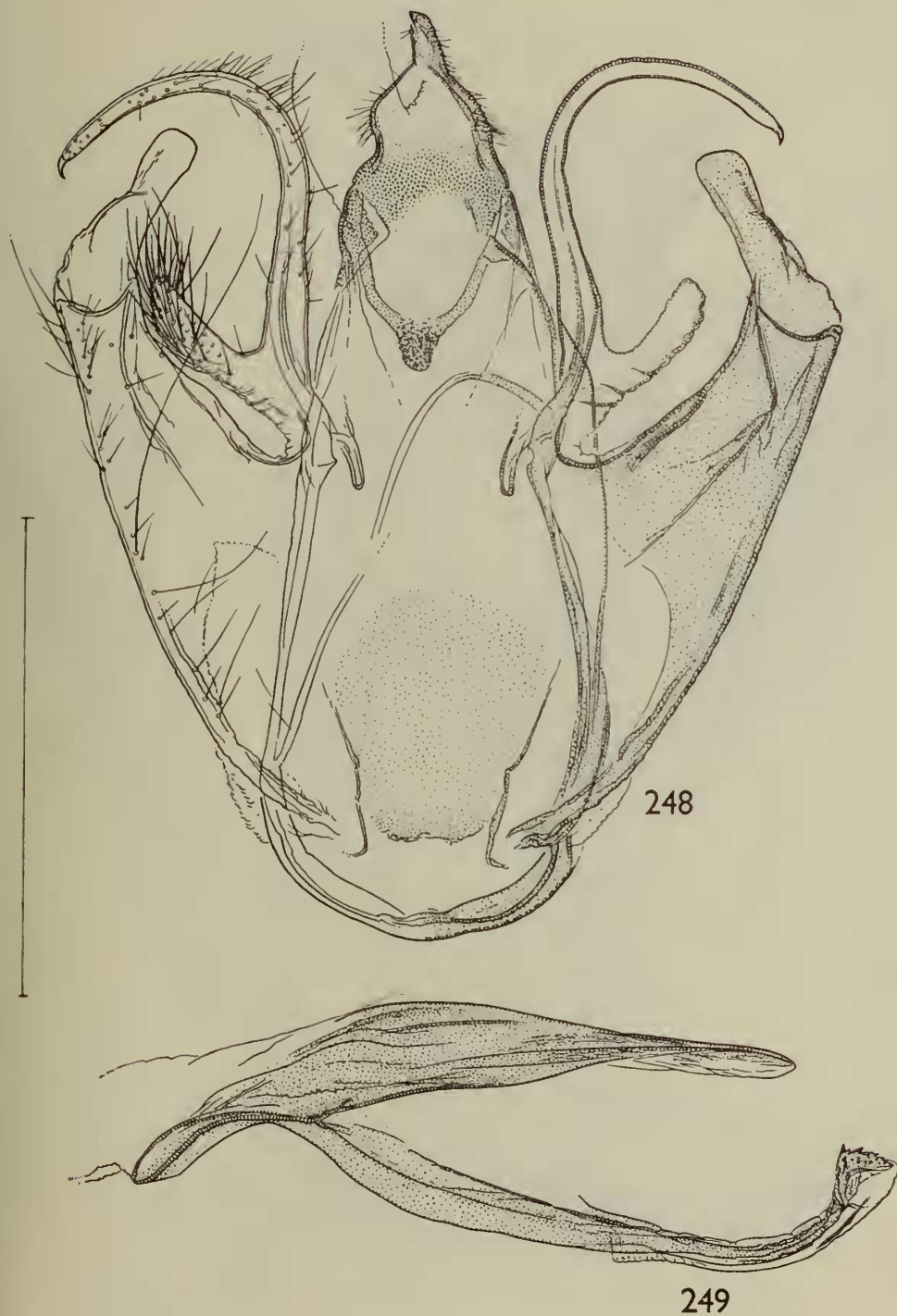
FIGS 242, 243. *Zamarada purimargo*, genitalia (A.S.). 242, ♂; 243, aedeagus.



FIGS 244, 245. *Zamarada dilucida*, genitalia (A.S.). 244, ♂; 245, aedeagus.



FIGS 246, 247. *Zamarada lepta*, genitalia (A.S.). 246, ♂; 247, aedeagus.



FIGS 248, 249. *Zamarada suda*, genitalia (A.S.). 248, ♂; 249, aedeagus.



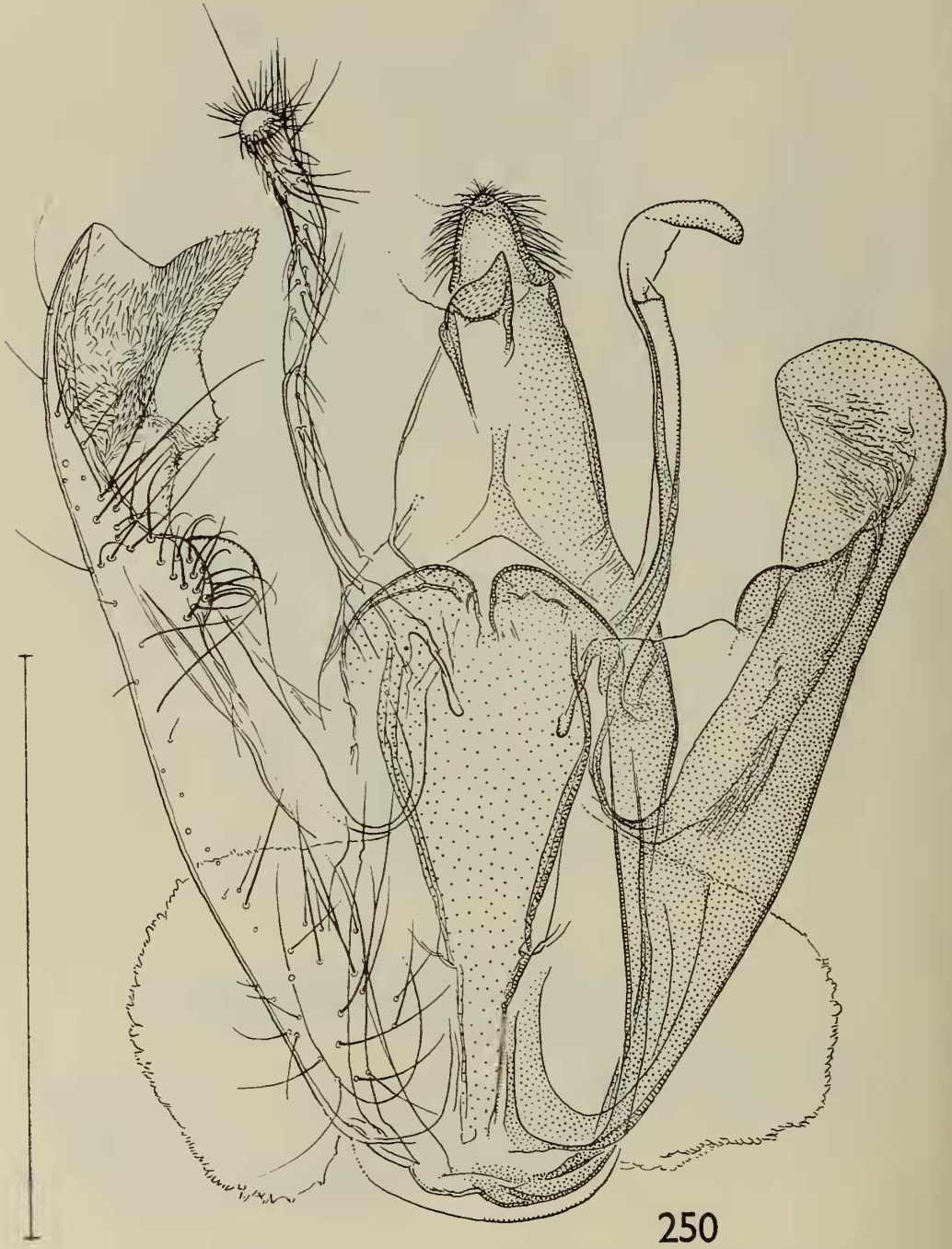


FIG. 250. *Zamarada nasuta*, ♂ genitalia (A.S.).

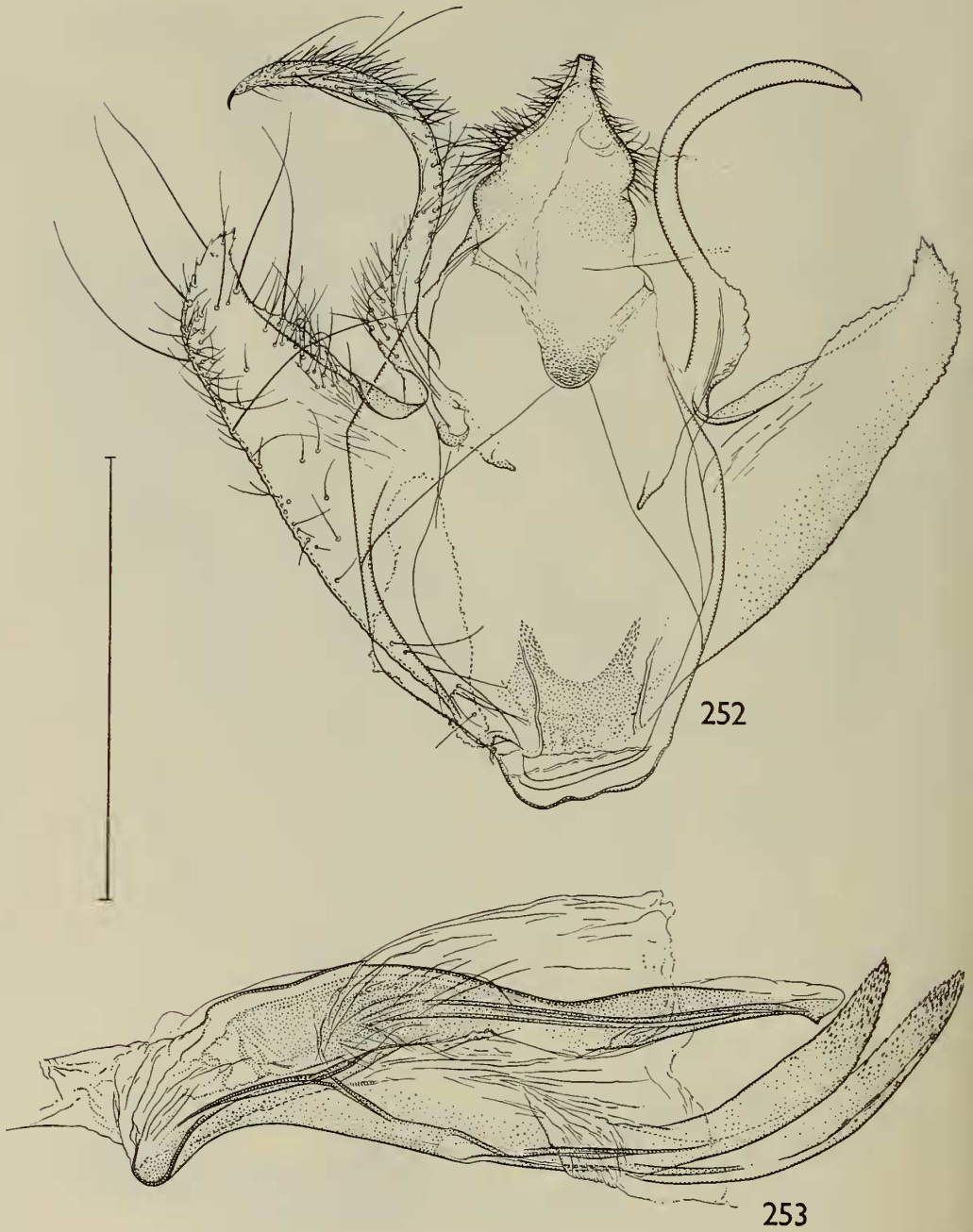


251



251A

FIGS 251, 251A. *Zamarada nasuta* ?subsp., genitalia, Cameroun (A.S.).  
251, ♂; 251A, aedeagus.

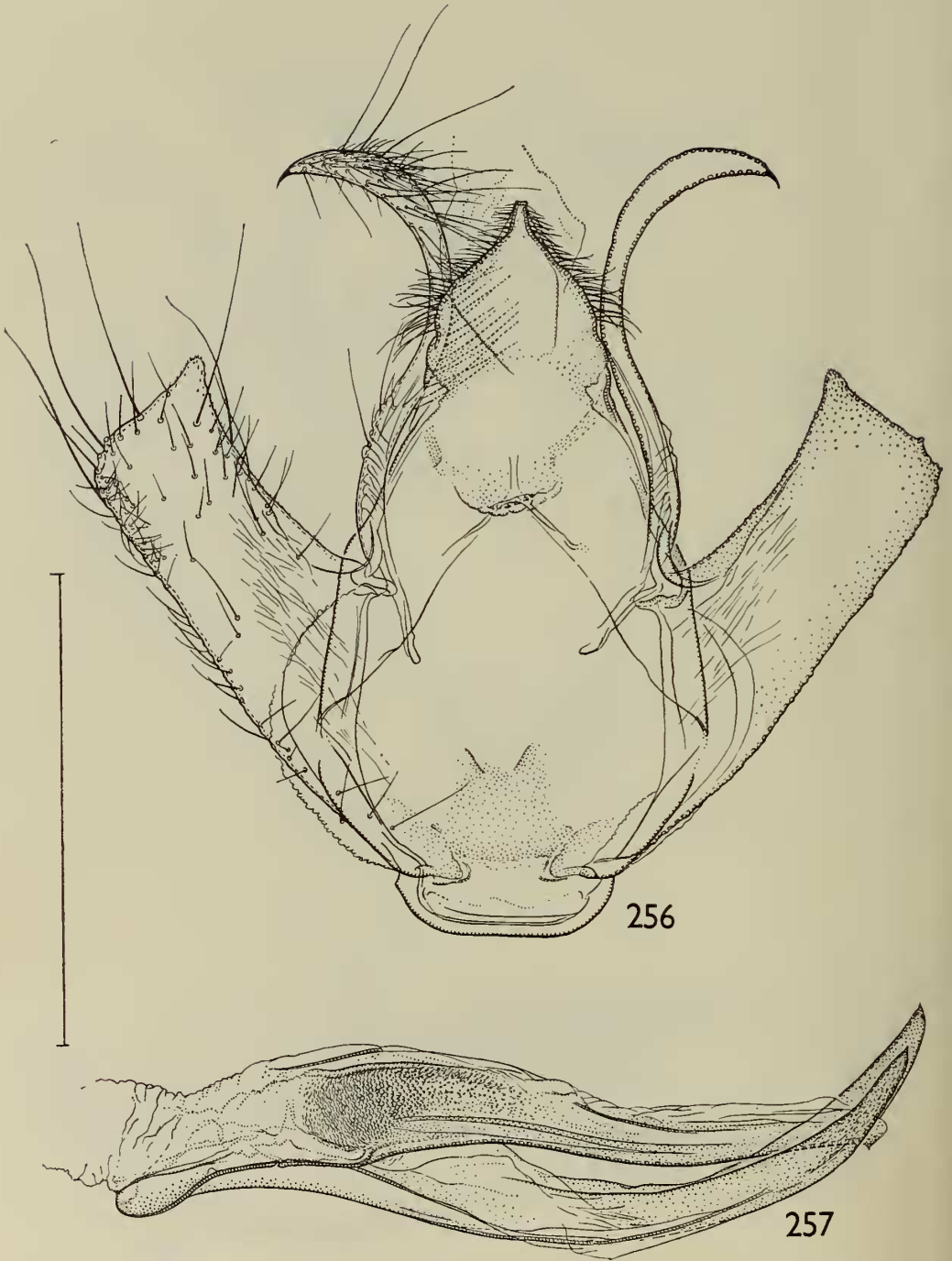


FIGS 252, 253. *Zamarada vulpina*, genitalia (A.S.). 252, ♂; 253, aedeagus.

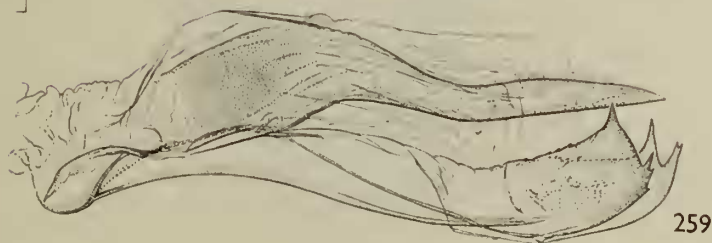


FIGS 254, 255. *Zamarada longidens*, genitalia (A.S.). 254, ♂; 255, aedeagus.

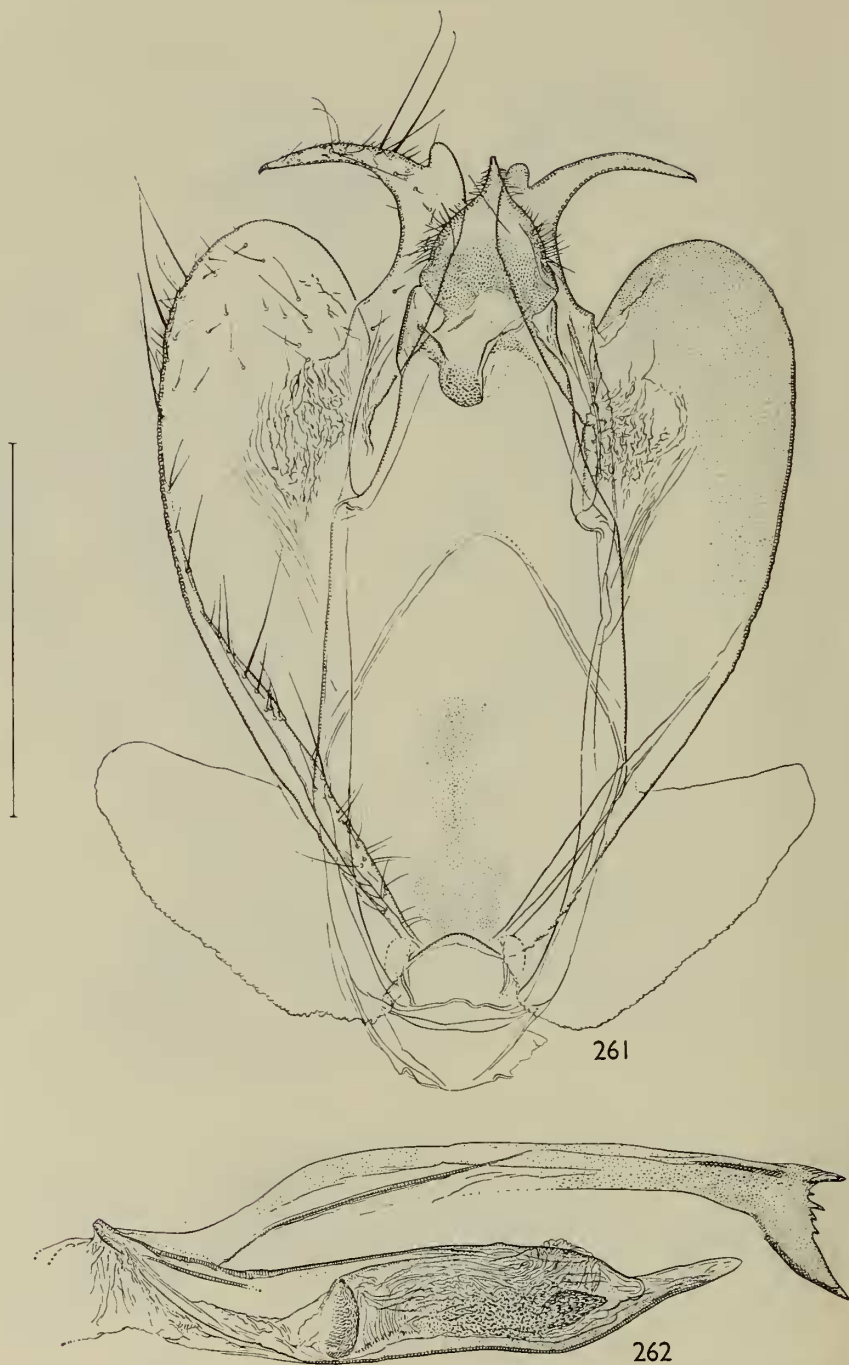




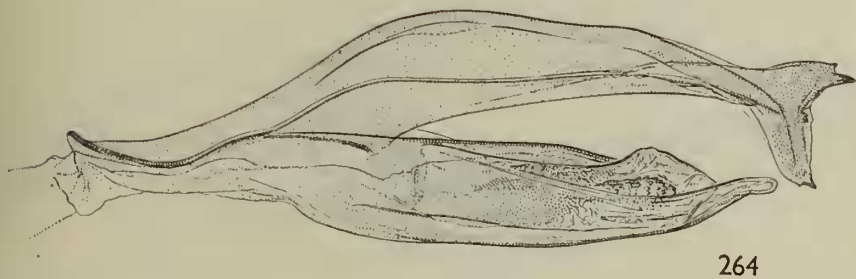
FIGS 256, 257. *Zamarada bastelbergi*, genitalia (A.S.). 256, ♂; 257, aedeagus.



FIGS 258-260. *Zamarada*, genitalia (A.S.). 258, 259, *dialitha*.  
258, ♂; 259, aedeagus. 260, *saburra*, aedeagus.

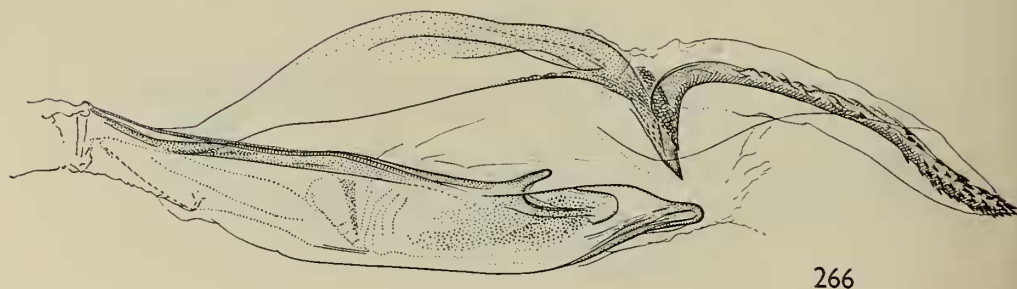


FIGS 261, 262. *Zamarada candelabra*, genitalia (A.S.). 261, ♂; 262, aedeagus.

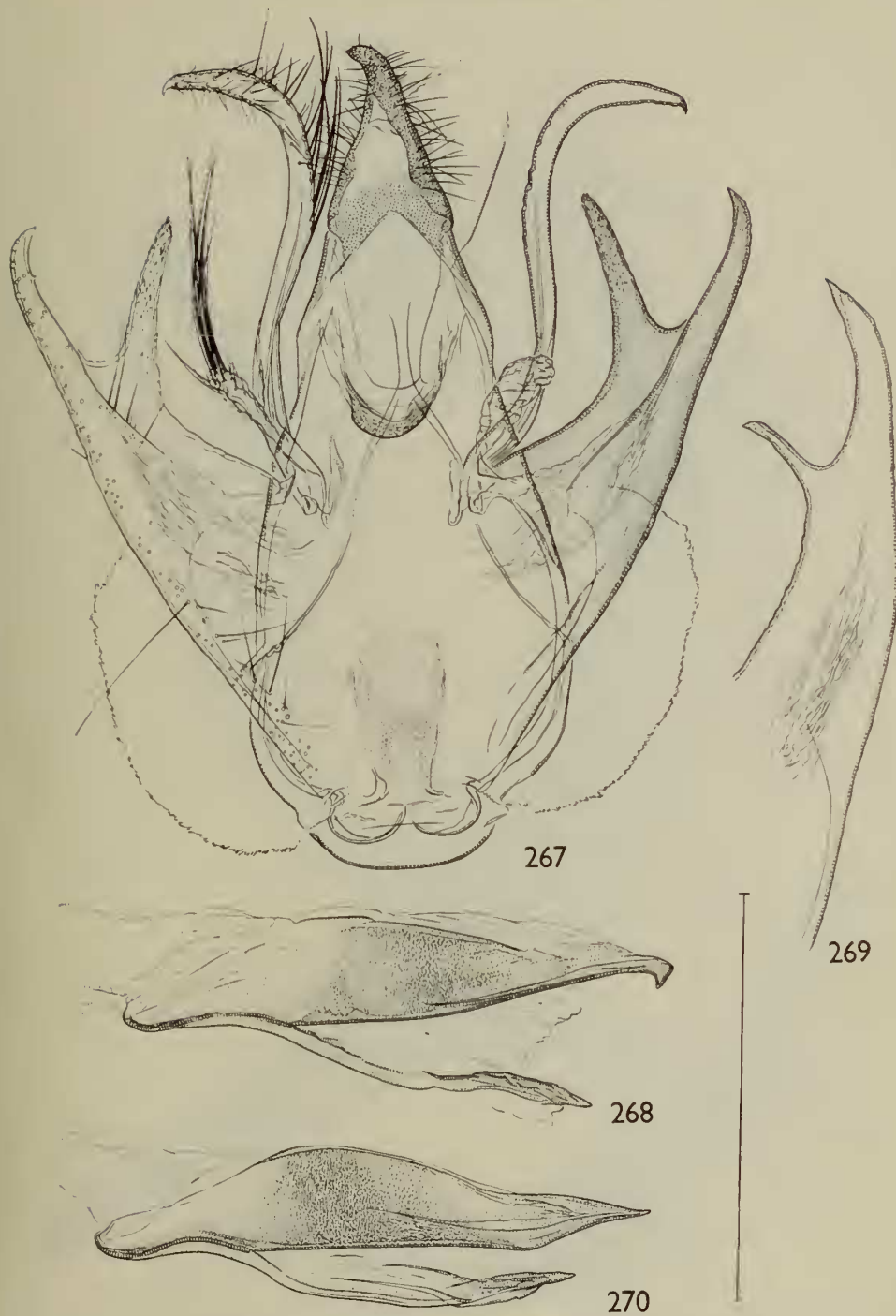


FIGS 263, 264. *Zamarada exigua*, genitalia (A.S.). 263, ♂; 264, aedeagus.

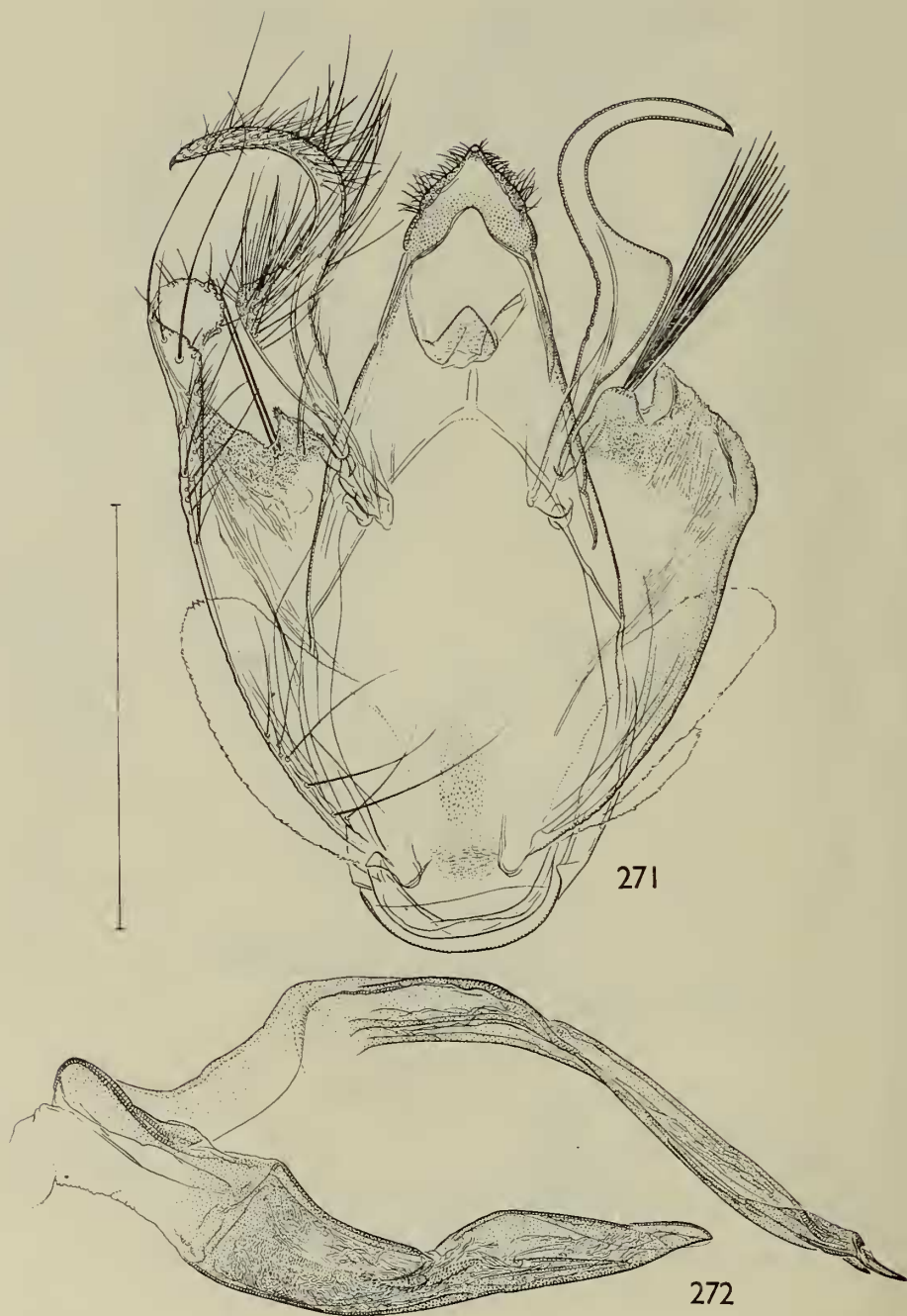




FIGS 265, 266. *Zamarada prolata*, genitalia (A.S.). 265, ♂; 266, aedeagus.



FIGS 267-270. *Zamarada*, genitalia (A.S.). 267, 268, *ignicosta hamulata*. 267, ♂; 268, aedeagus. 269, 270, *ignicosta ignicosta*. 269, ♂; 270, aedeagus.

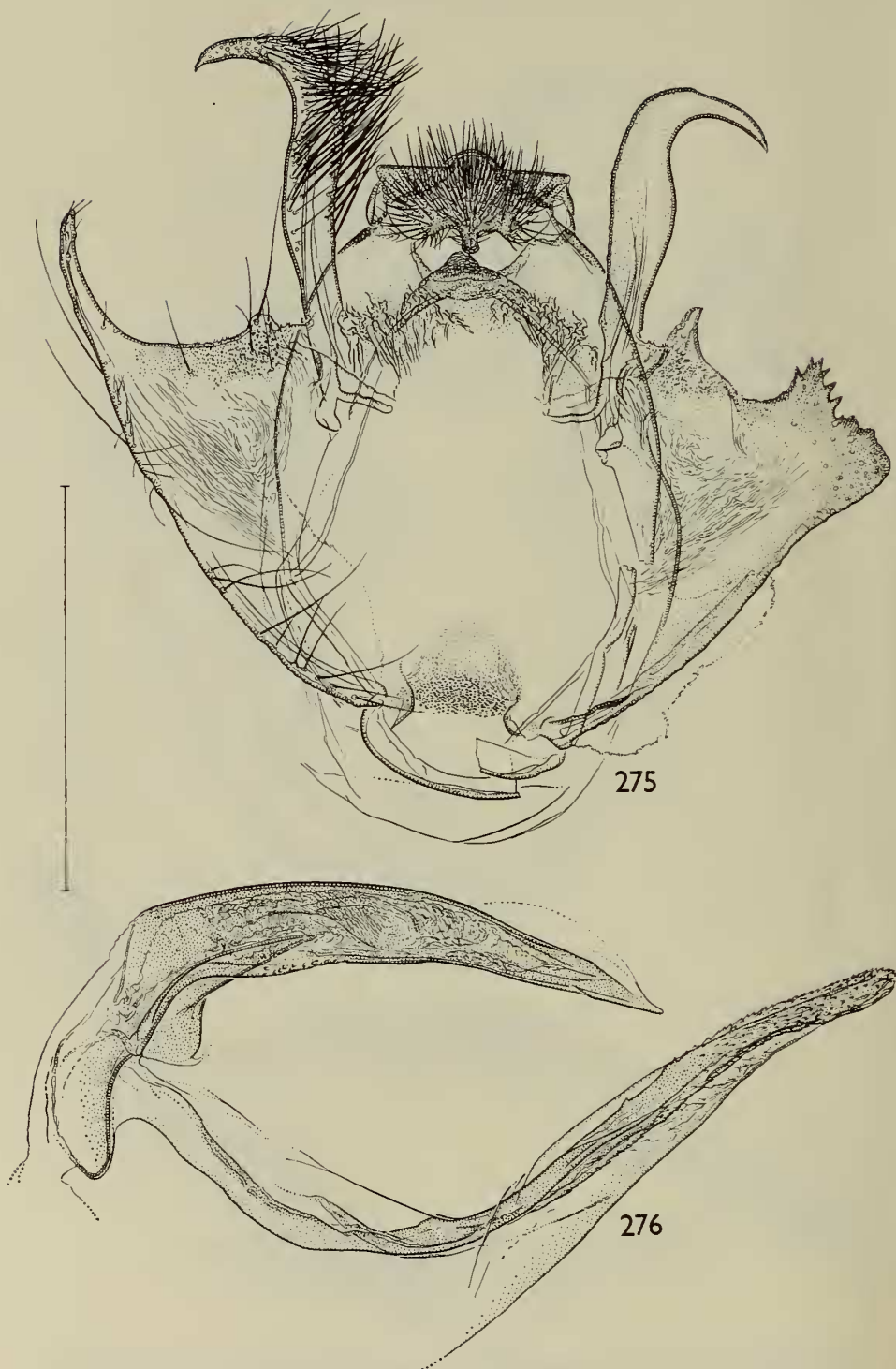


FIGS 271, 272. *Zamarada scintillans*, genitalia (A.S.). 271, ♂; 272, aedeagus.

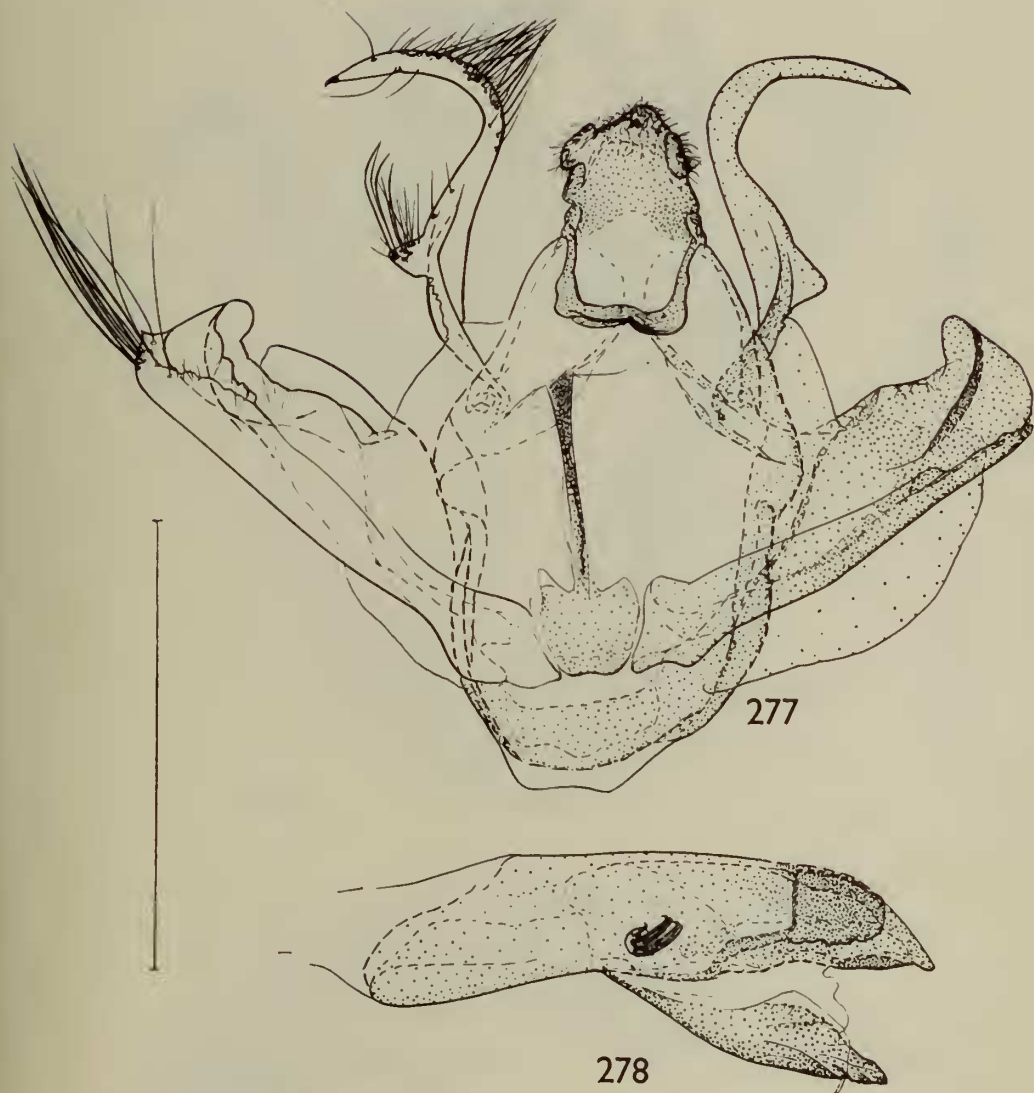


FIGS 273, 274. *Zamarada flavicaput*, genitalia (A.S.). 273, ♂; 274, aedeagus.

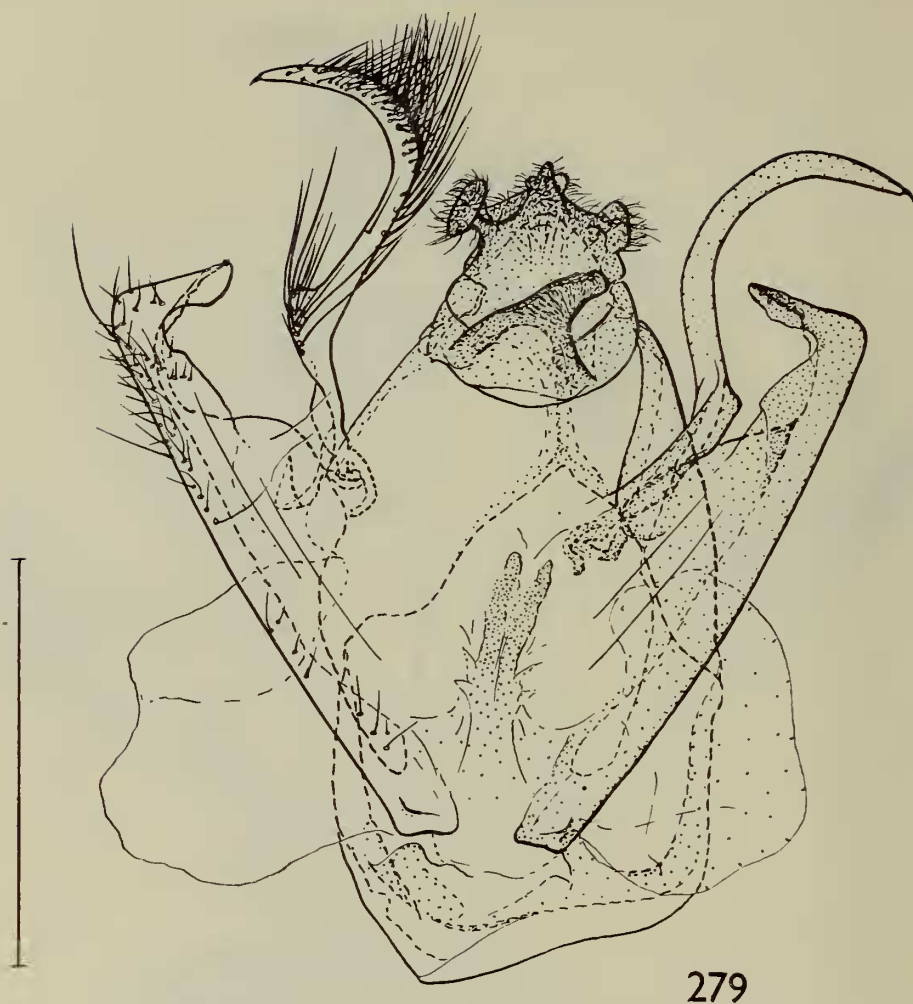




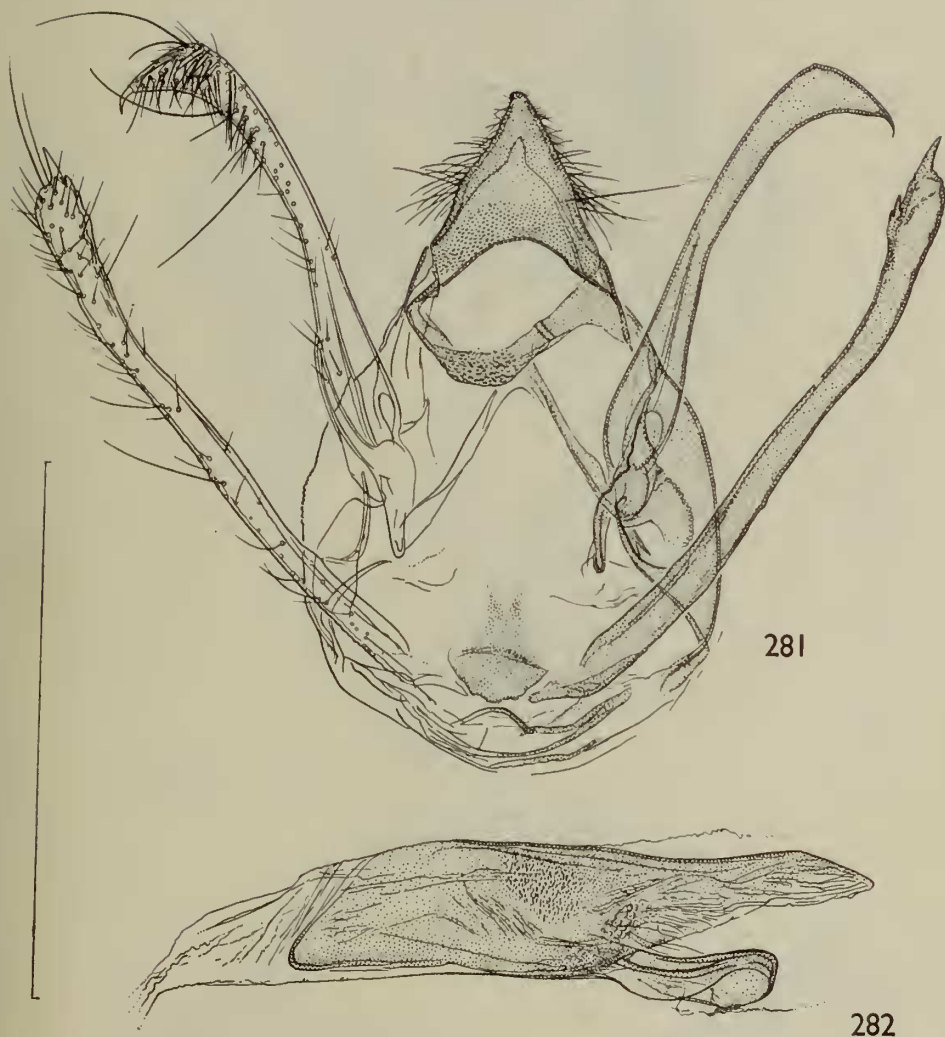
FIGS 275, 276. *Zamarada gracilata*, genitalia (A.S.). 275, ♂; 276, aedeagus.



FIGS 277, 278. *Zamarada euphrosyne*, genitalia (J. A.). 277, ♂; 278, aedeagus.



FIGS 279, 280. *Zamarada rufilinearia*, genitalia (J. A.). 279, ♂; 280, aedeagus.

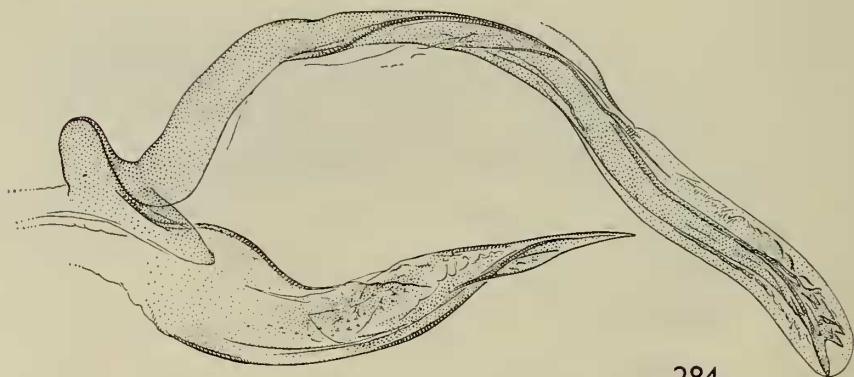


FIGS 281, 282. *Zamarada kompsotes*, genitalia (A.S.). 281, ♂; 282, aedeagus.





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FIGS 283, 284. *Zamarada denticatella*, genitalia (A.S.). 283, ♂; 284, aedeagus.

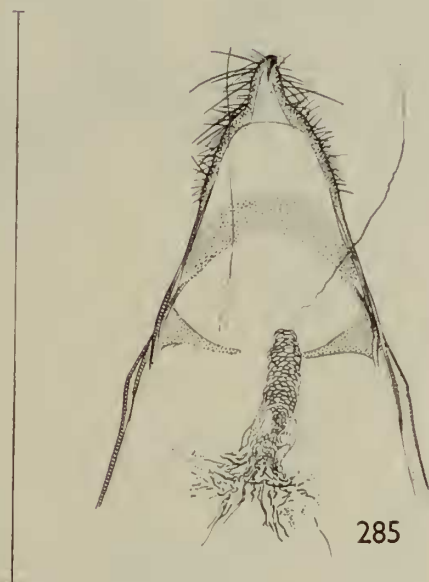


FIG. 285 *Zamarada densiparsa*, uncus and fultura superior (A.S.).

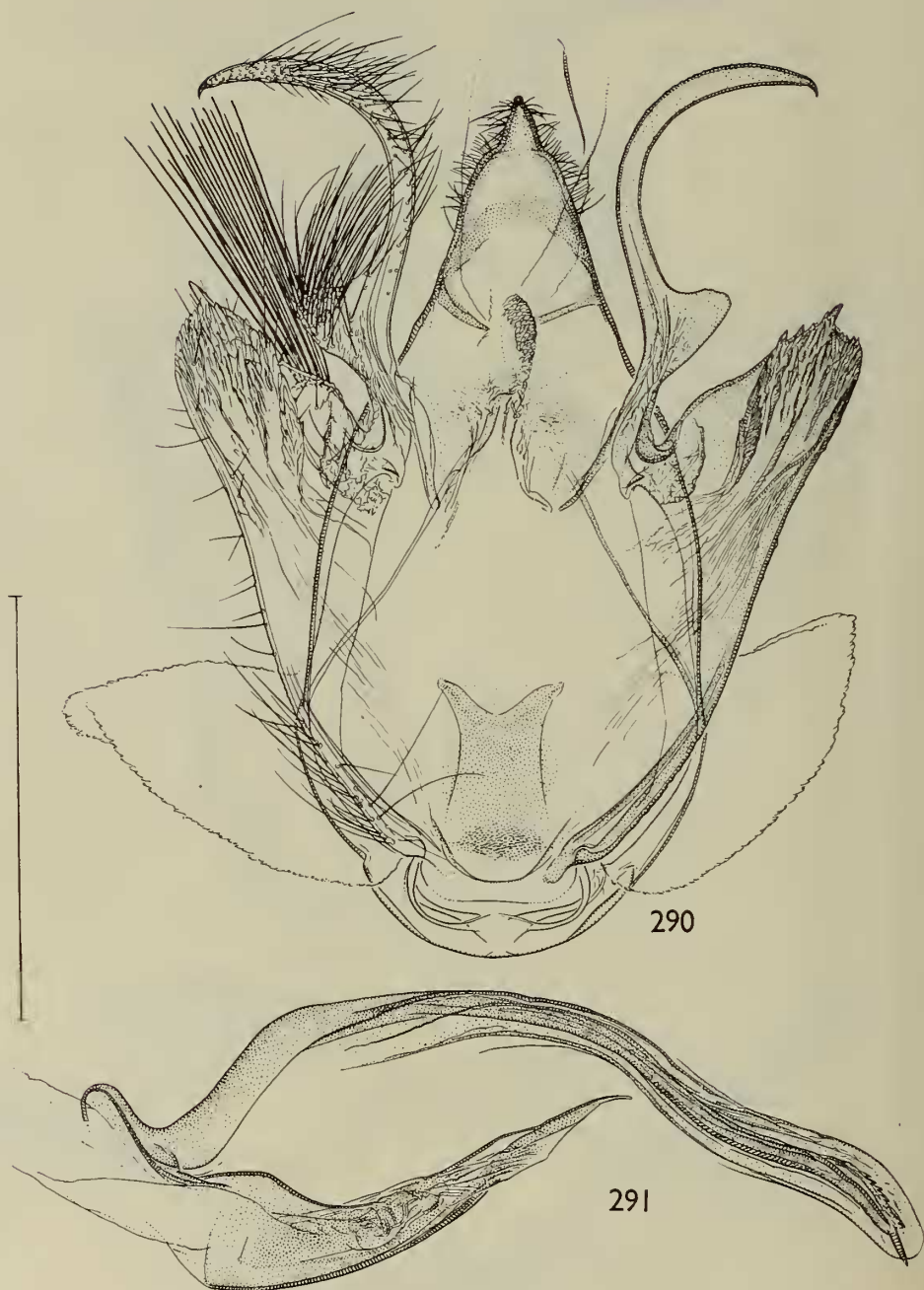


FIGS 286, 287. *Zamarada fessa*, genitalia (A.S.). 286, ♂; 287, aedeagus.

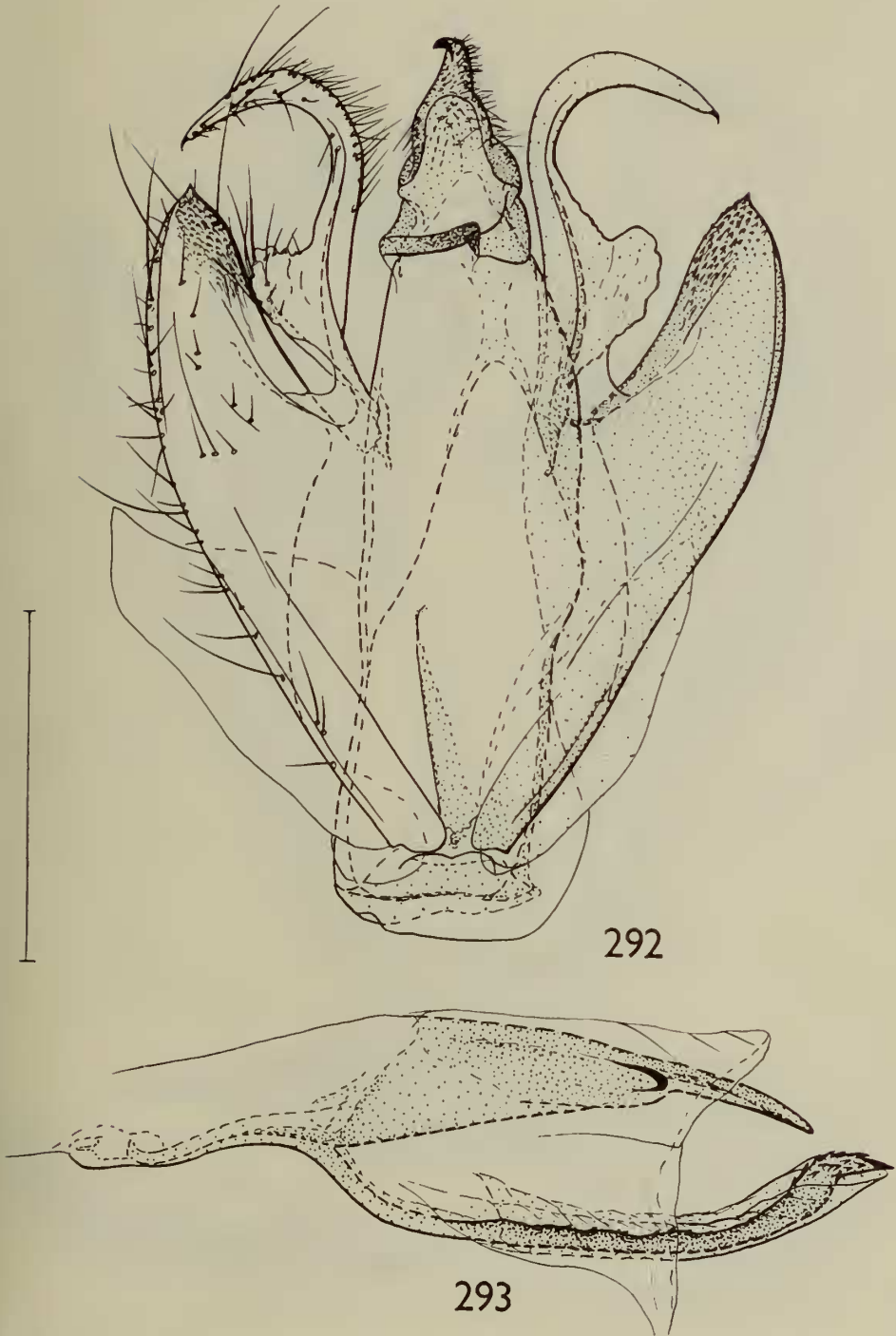


FIGS 288, 289. *Zamarada euterpina*, genitalia (A.S.). 288, ♂; 289, aedeagus.

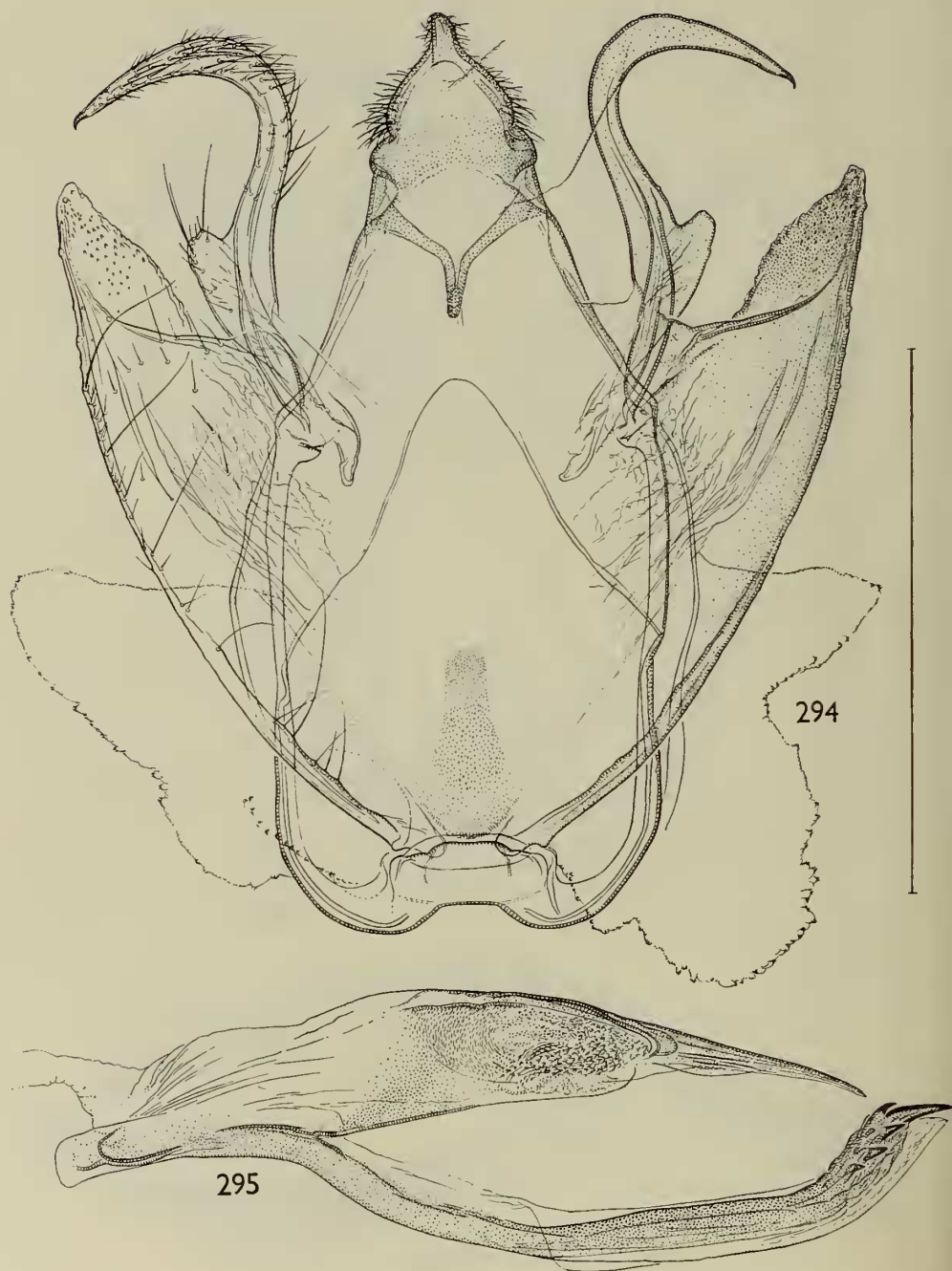




FIGS 290, 291. *Zamarada dorsiplaga*, genitalia (A.S.). 290, ♂; 291, aedeagus.



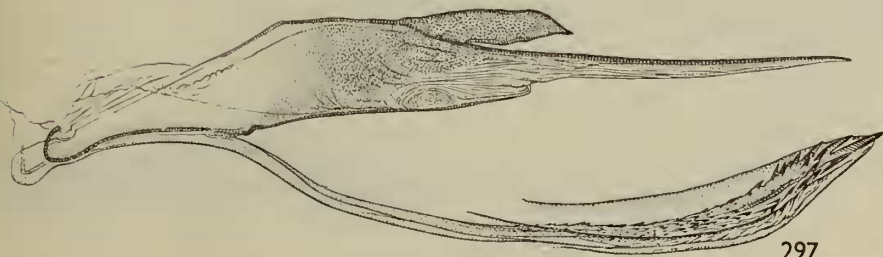
FIGS 292, 293. *Zamarada metrioscaphes*, genitalia (J. A.). 292, ♂; 293, aedeagus.



FIGS 294, 295. *Zamarada seydeli*, genitalia (A.S.). 294, ♂; 295, aedeagus.



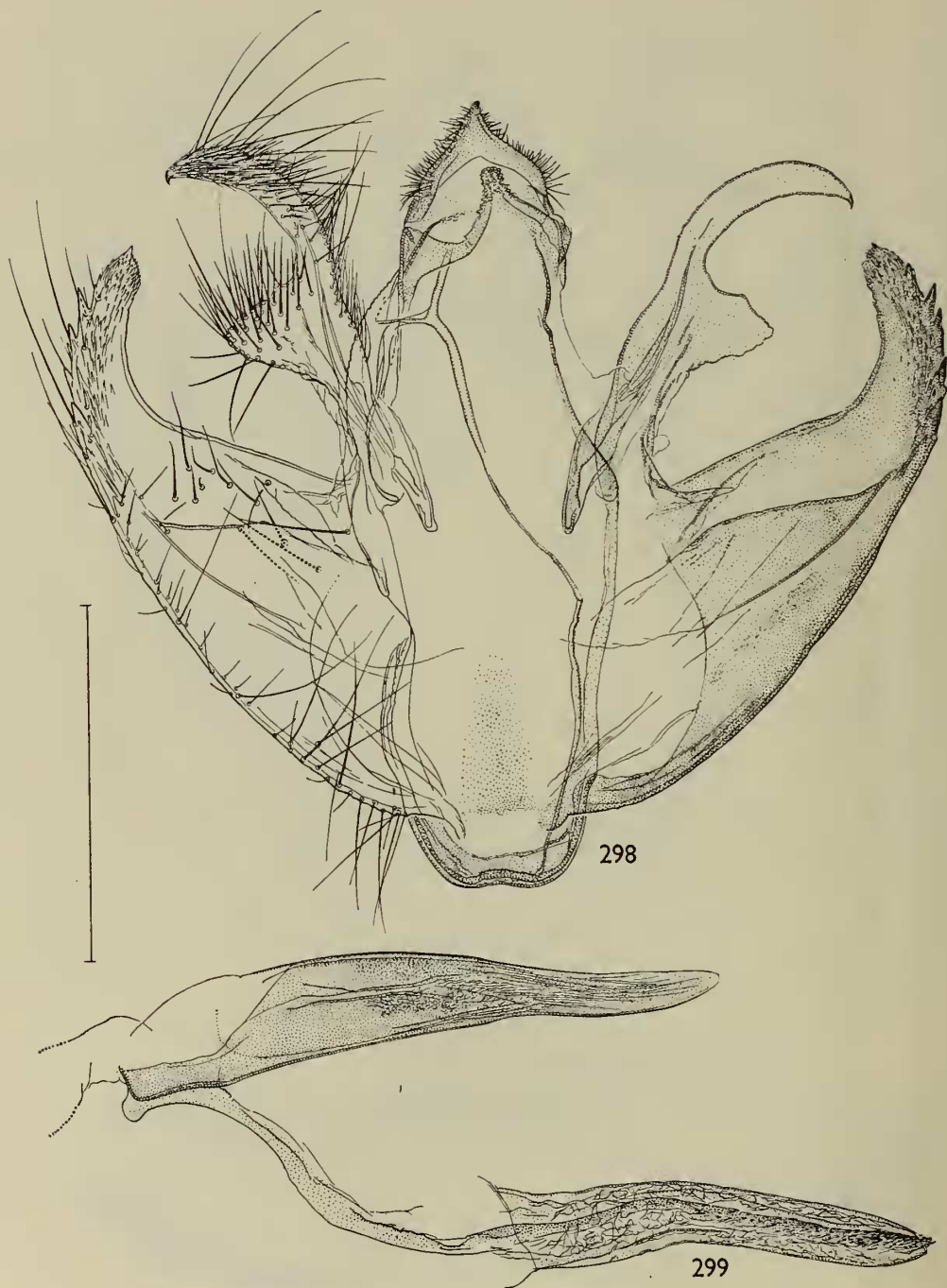
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FIGS 296, 297. *Zamarada glareosa*, genitalia (A.S.). 296, ♂; 297, aedeagus.

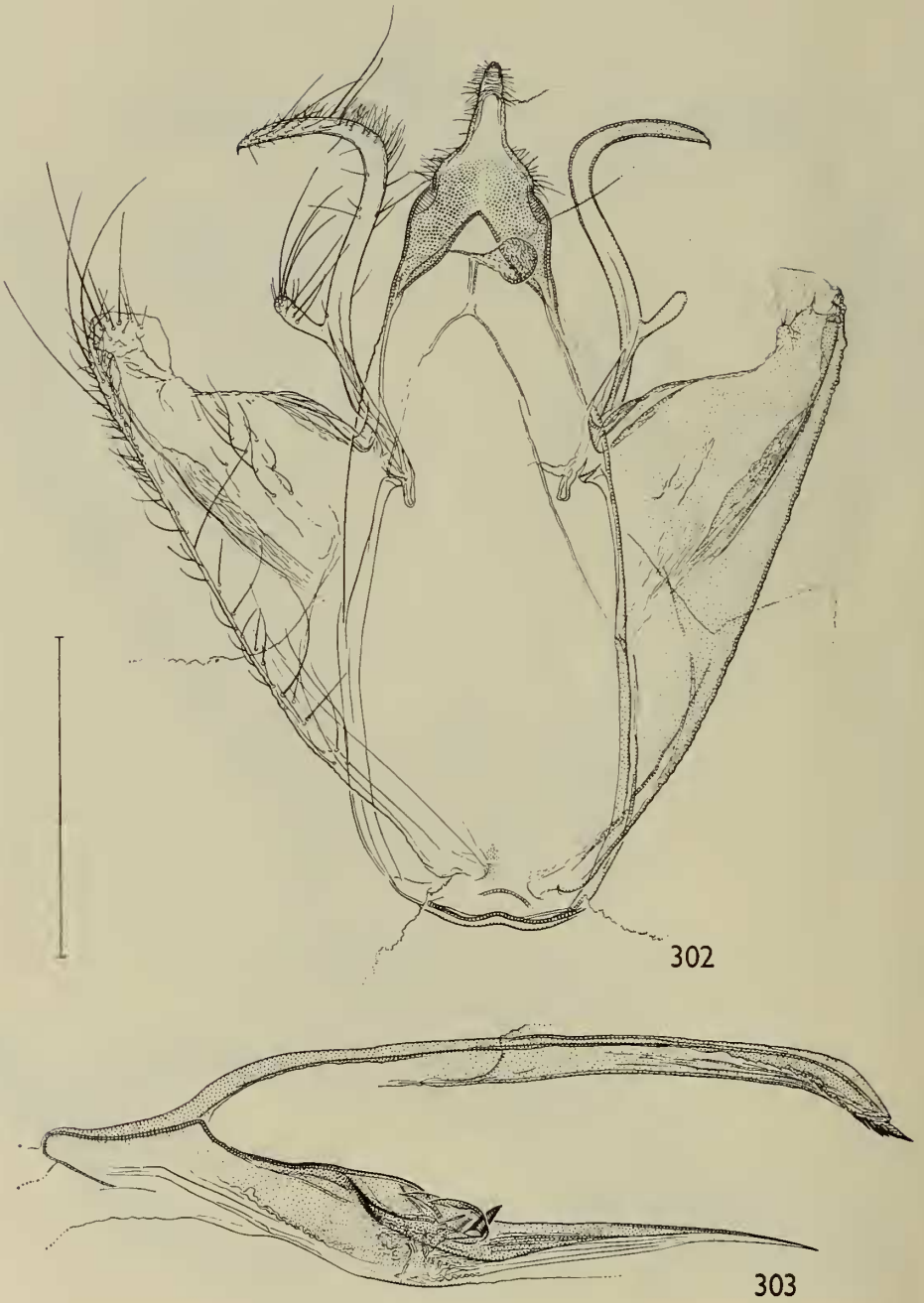




FIGS 298, 299. *Zamarada rubrifascia*, genitalia (A.S.). 298, ♂; 299, aedeagus.



FIGS 300, 301, *Zamarada plana*, genitalia (A.S.). 300, ♂; 301, aedeagus.

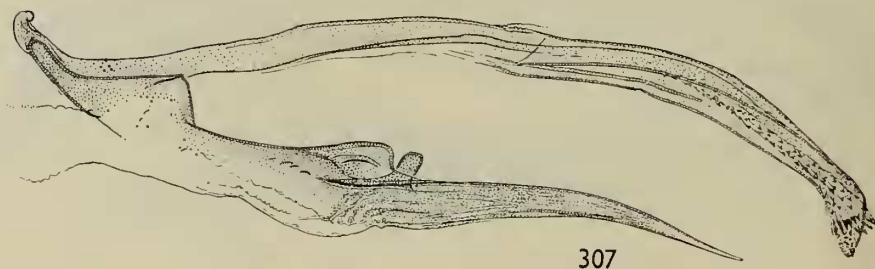


FIGS 302, 303. *Zamarada varii*, genitalia (A.S.). 302, ♂; 303, aedeagus.



FIGS 304, 305. *Zamarada astyphela*, genitalia (A.S.). 304, ♂; 305, aedeagus.

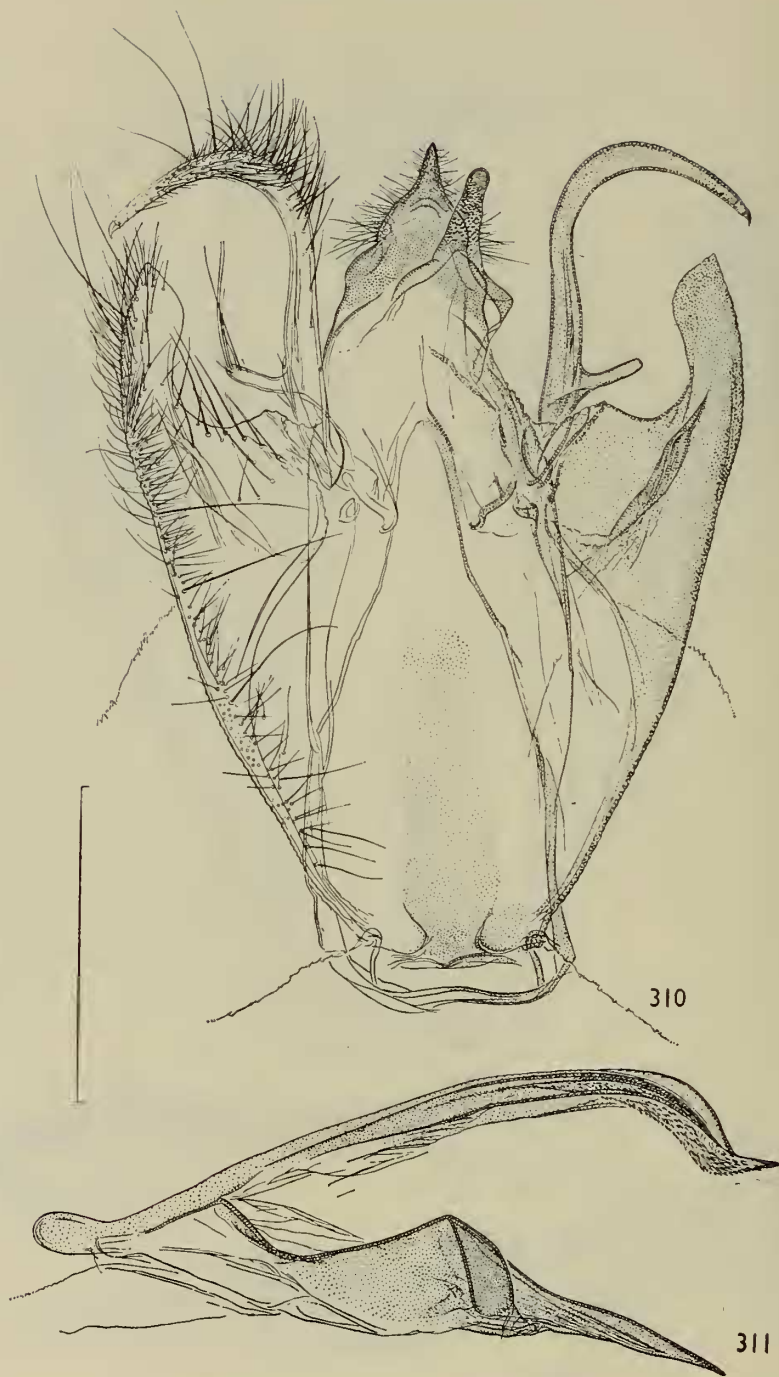




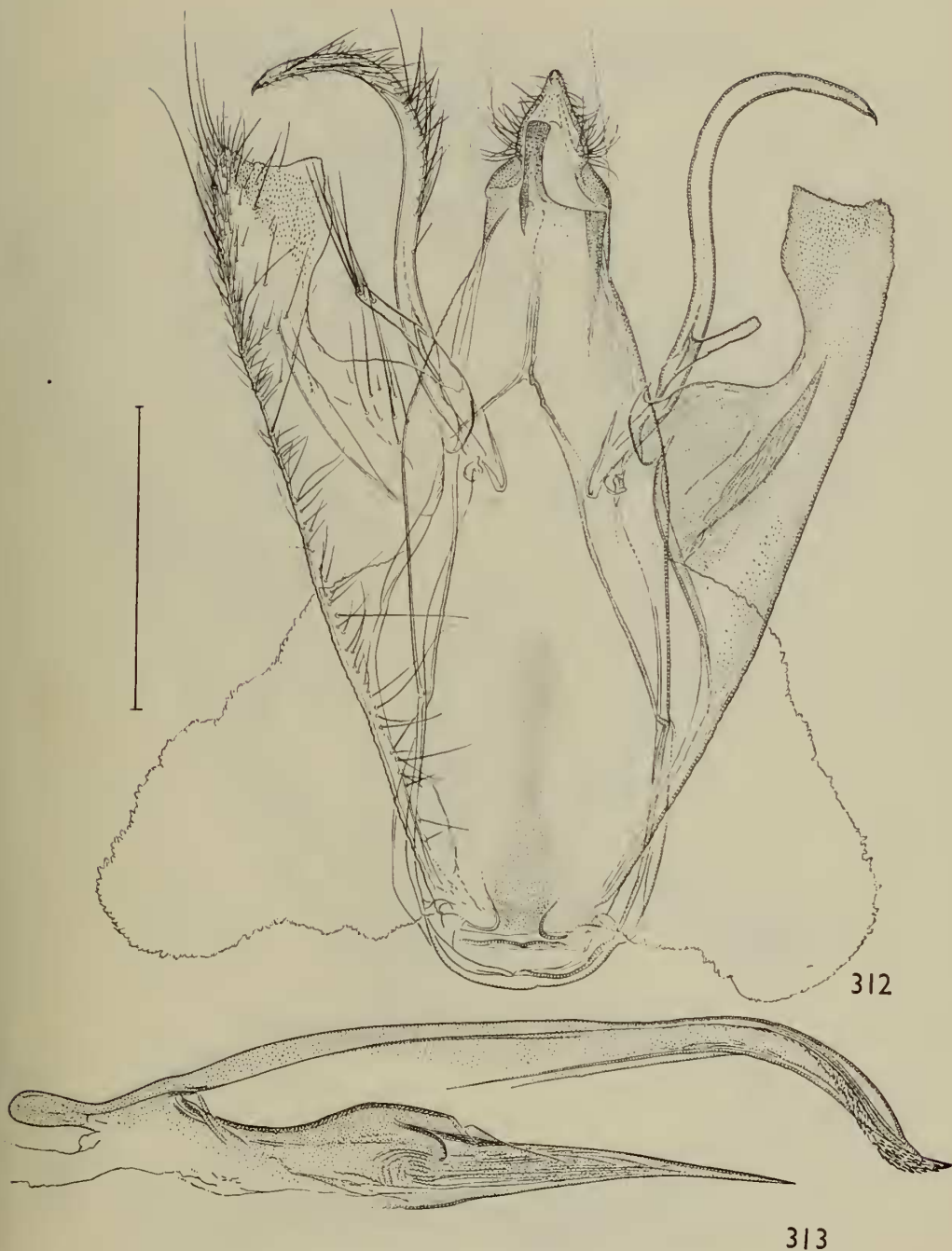
FIGS 306, 307. *Zamarada griseola*, genitalia (A.S.). 306, ♂; 307, aedeagus.



FIGS 308, 309. *Zamarada euerces*, genitalia (A.S.). 308, ♂; 309, aedeagus.



FIGS 310, 311. *Zamarada geitaina*, genitalia (A.S.). 310, ♂; 311, aedeagus.



FIGS 312, 313. *Zamarada phrontisaria*, genitalia (A.S.). 312, ♂; 313, aedeagus.

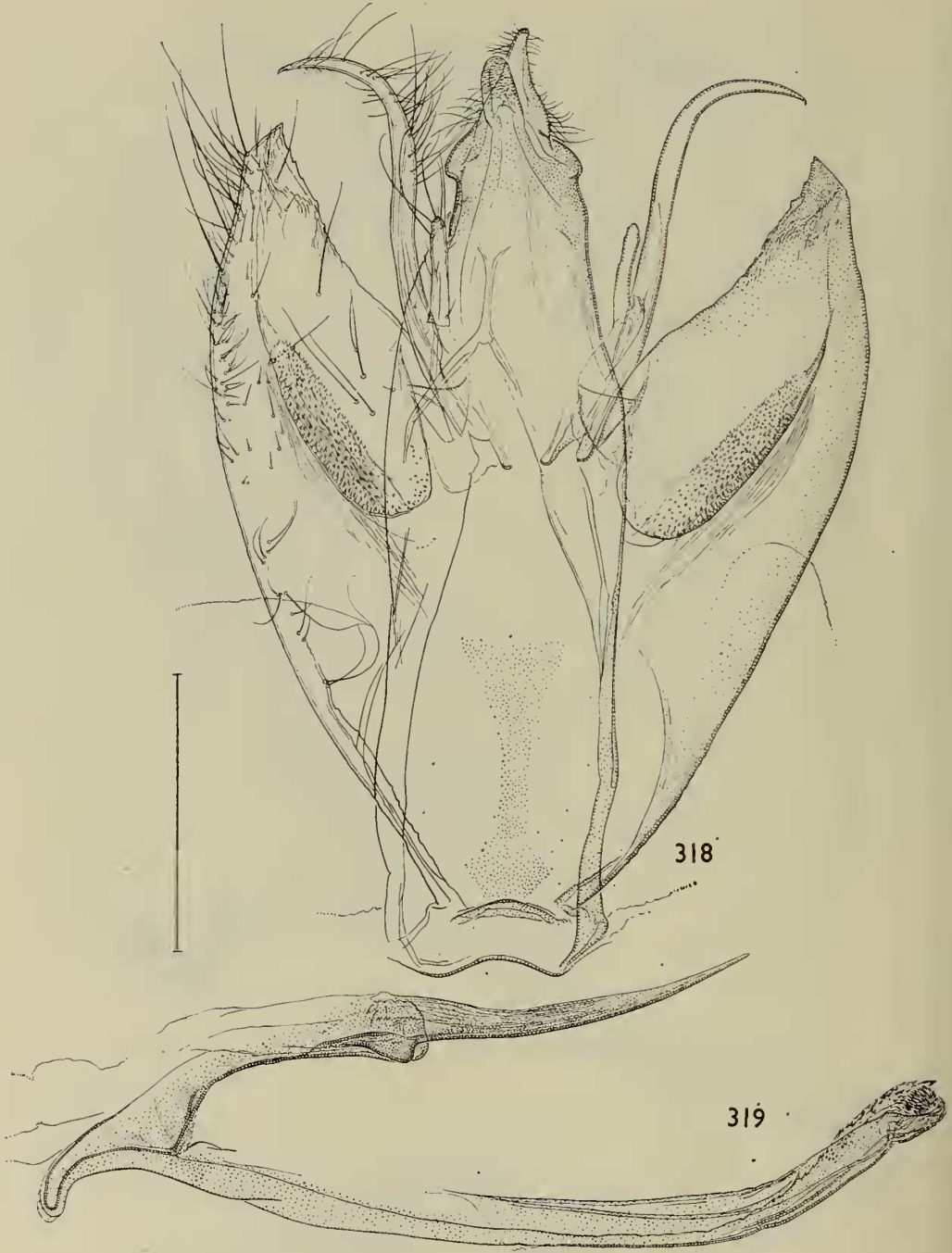




FIGS 314, 315. *Zamarada fumosa*, genitalia (A.S.). 314, ♂; 315, aedeagus.



FIGS 316, 317. *Zamarada cathetus*, genitalia (A.S.). 316, ♂; 317, aedeagus.

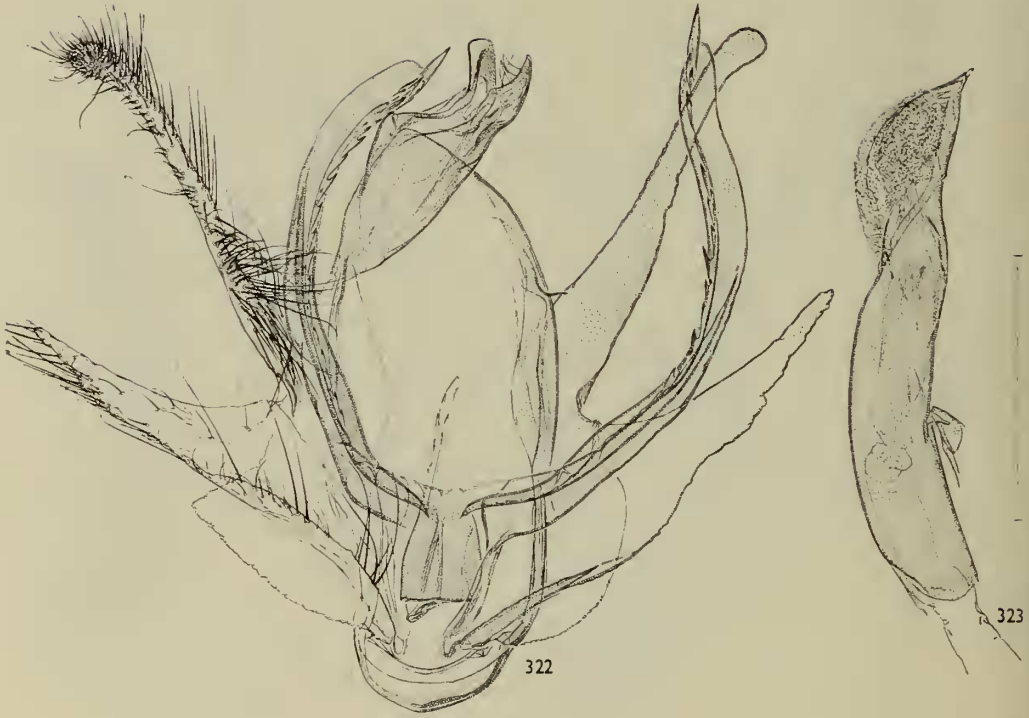


FIGS 318, 319. *Zamarada unisona*, genitalia (A.S.). 318, ♂; 319, aedeagus.

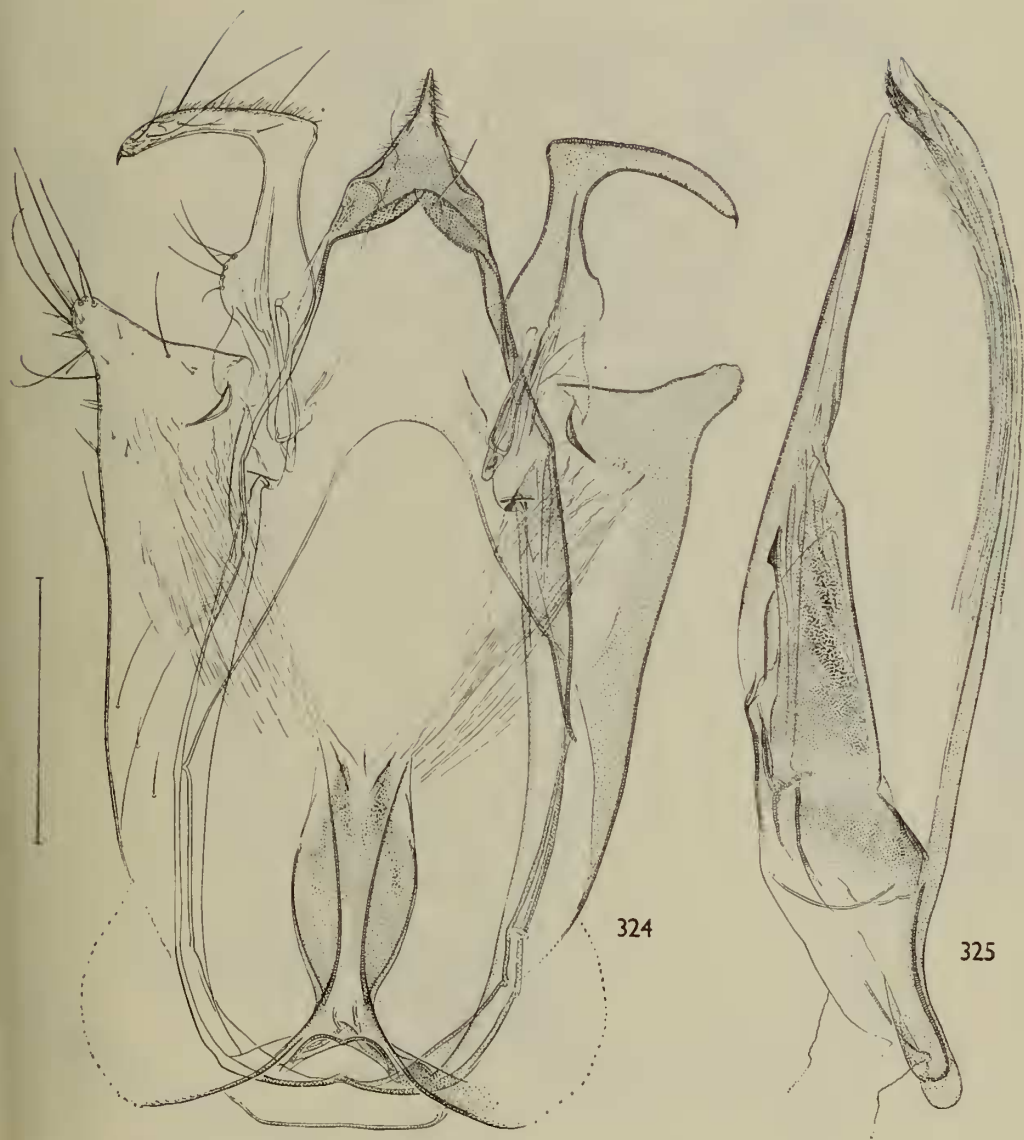


FIGS 320, 321. *Zamarada acosmeta*, genitalia (A.S.). 320, ♂; 321, aedeagus.

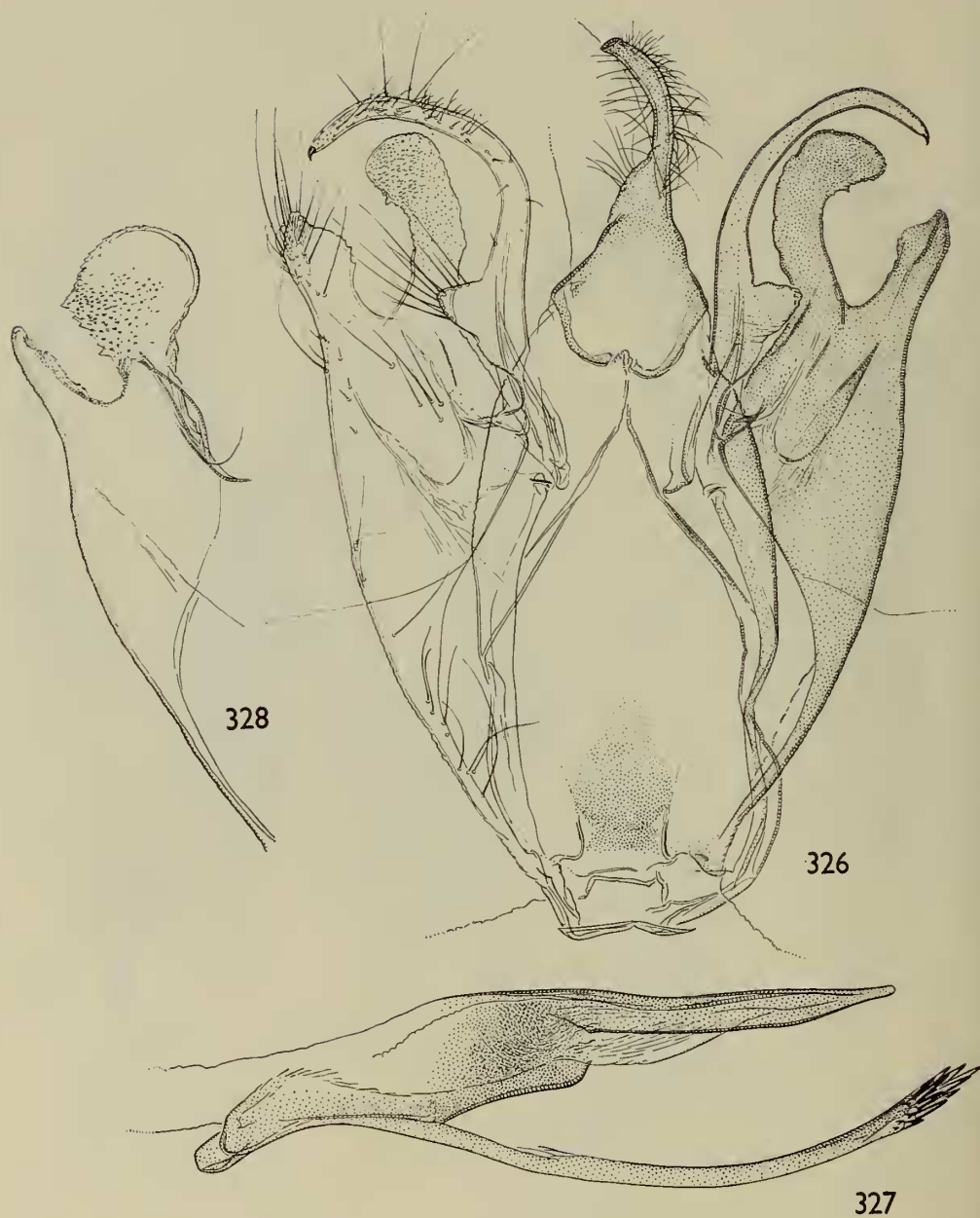




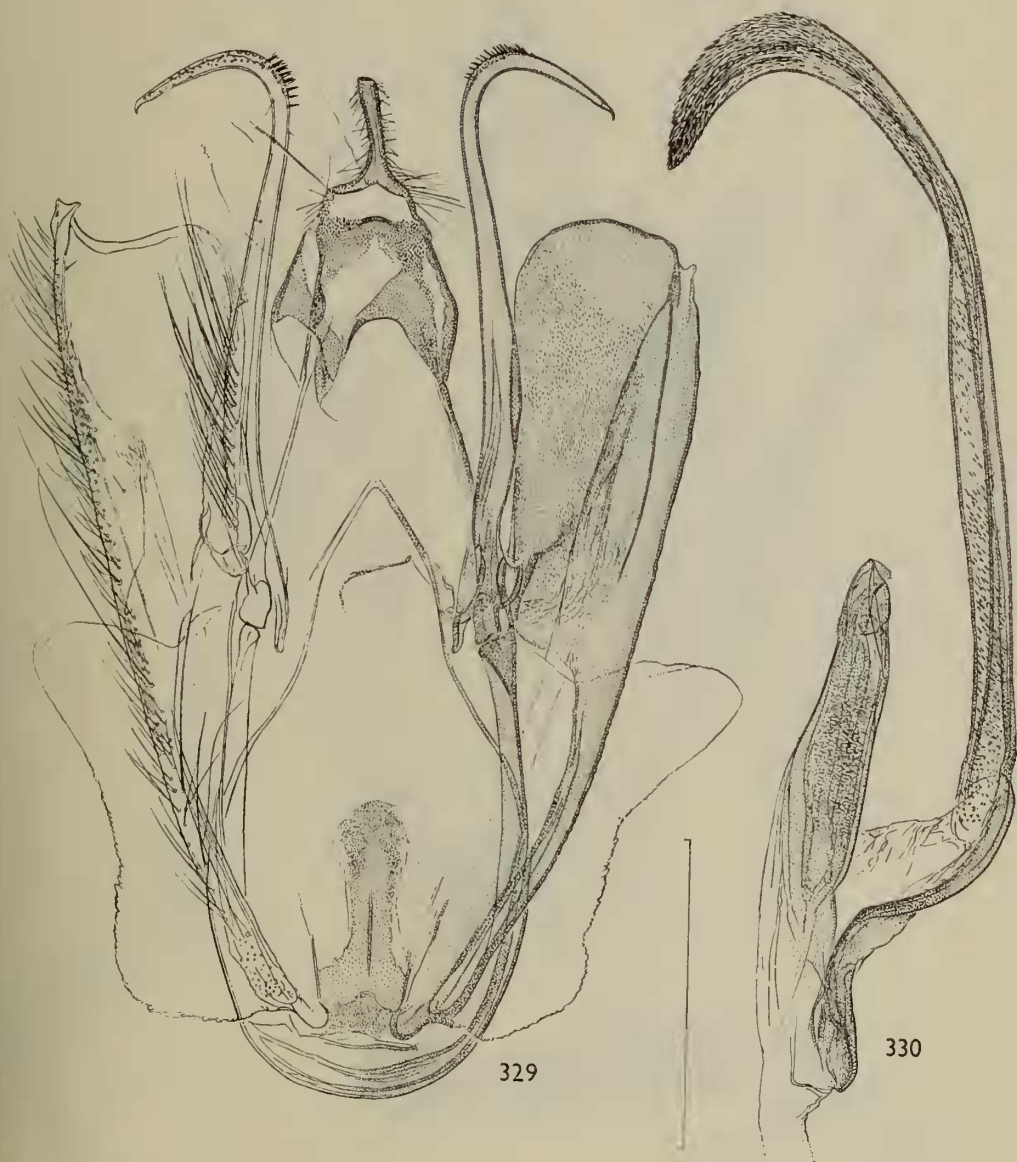
FIGS 322, 323. *Zamarada pinheyi*, genitalia (A.S.). 322, ♂; 323, aedeagus.



FIGS 324, 325. *Zamarada dione*, genitalia (A.S.). 324, ♂; 325, aedeagus.



FIGS 326-328. *Zamarada*, genitalia (A.S.). 326, 327, *labifera labifera*. 326, ♂; 327, aedeagus. 328, *labifera discata*, apex of left valve.

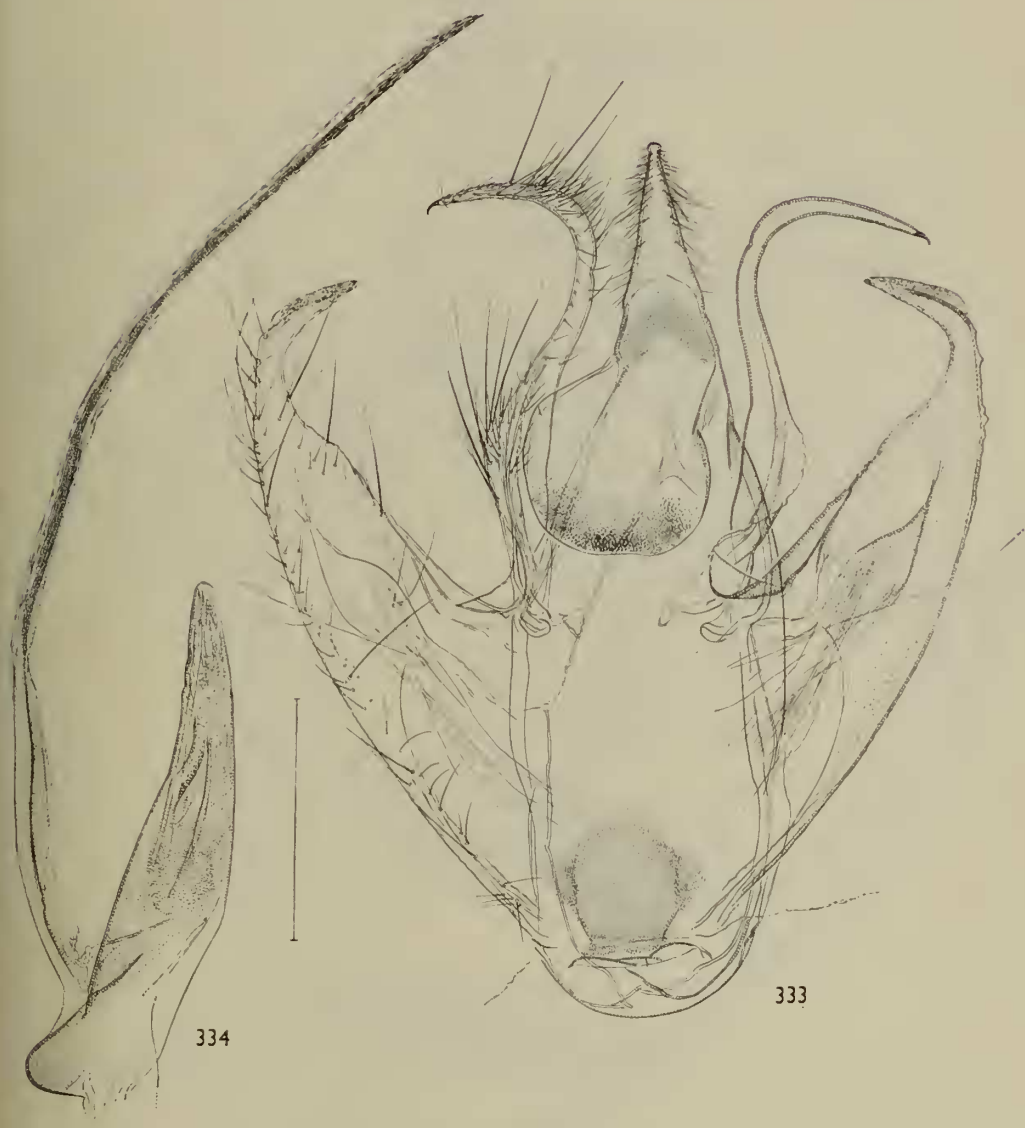


FIGS 329, 330. *Zamarada cydippe*, genitalia (A.S.). 329, ♂; 330, aedeagus.





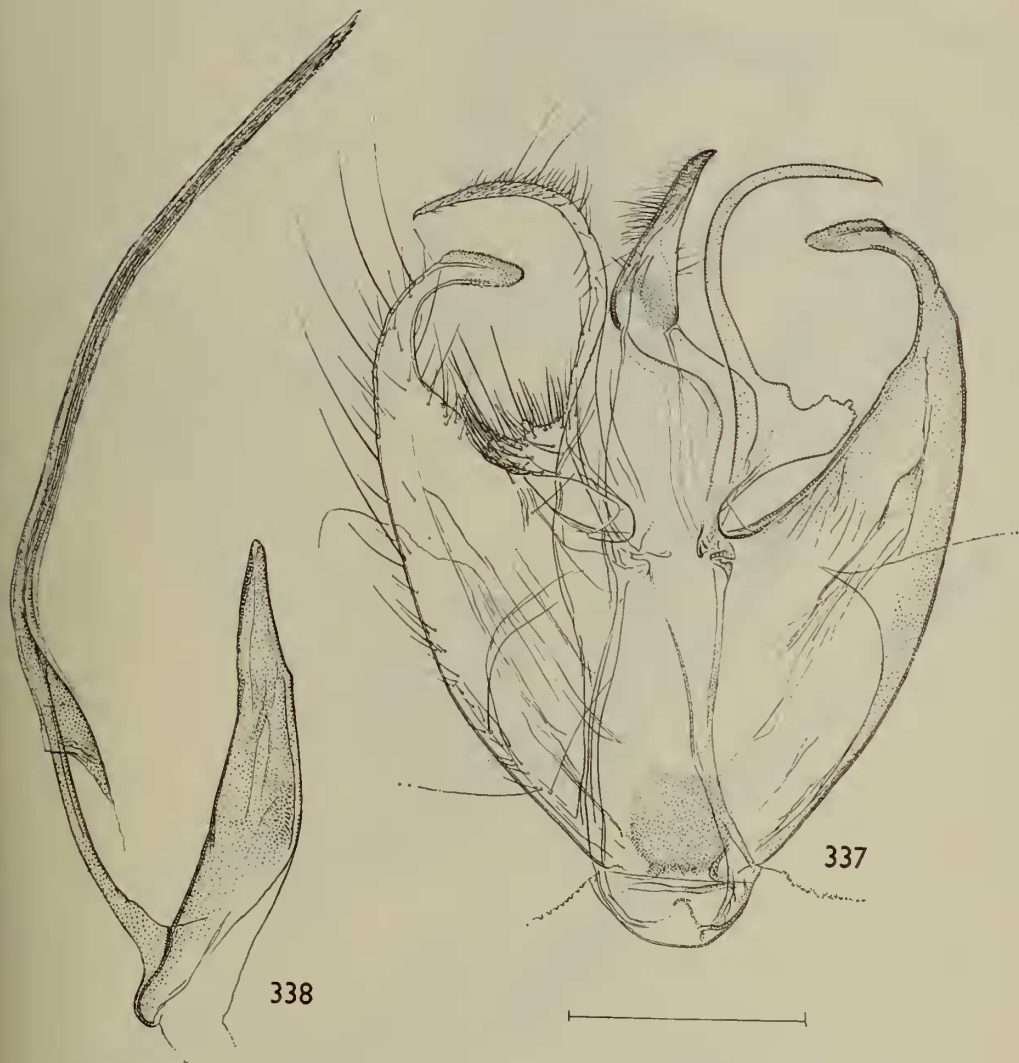
FIGS 331, 332. *Zamarada adumbrata*, genitalia (A.S.). 331, ♂; 332, aedeagus.



FIGS 333, 334. *Zamarada dilata*, genitalia (A.S.). 333, ♂; 334, aedeagus.



FIGS 335, 336. *Zamarada enippe*, genitalia (A.S.). 335, ♂; 336, aedeagus.

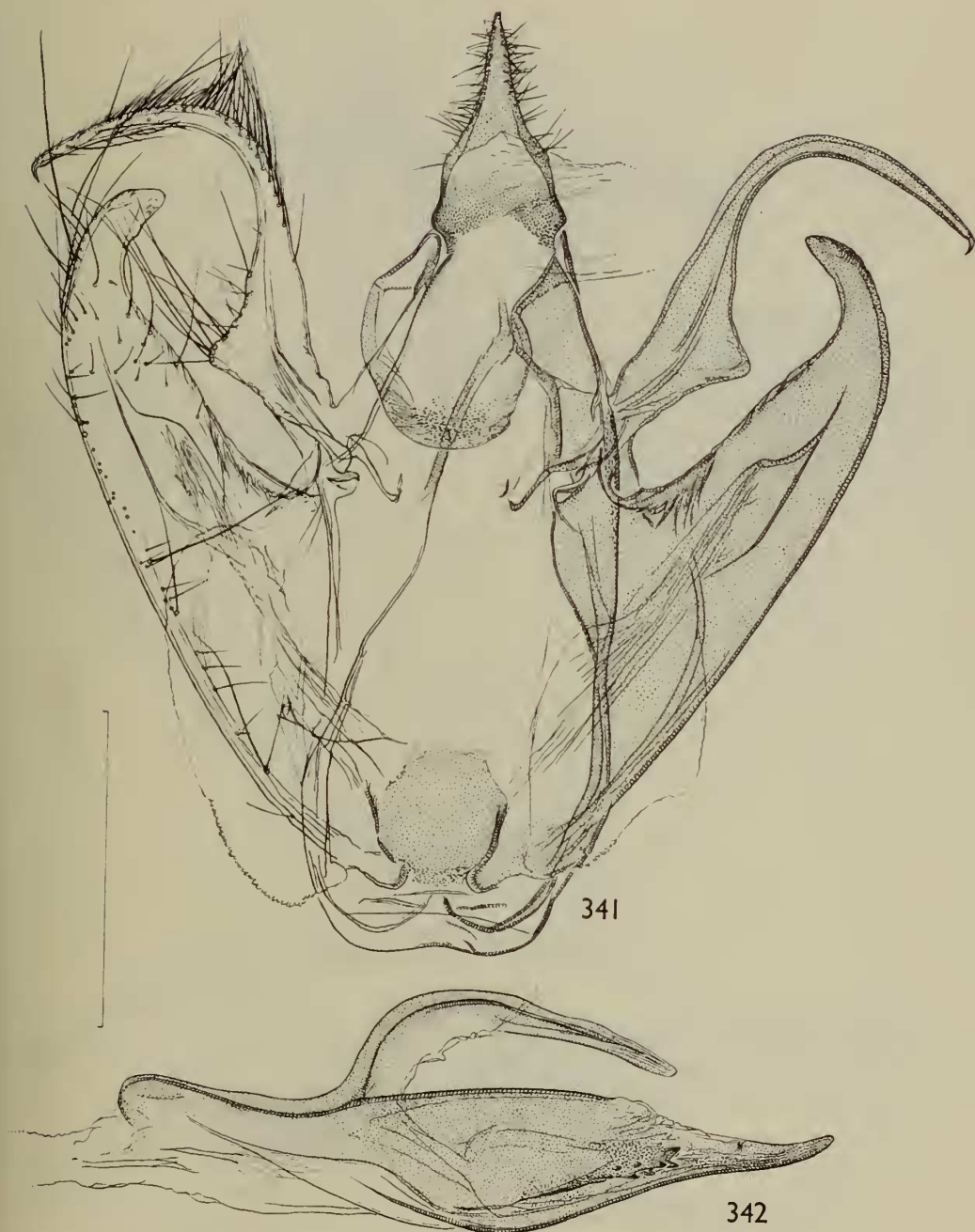


FIGS 337, 338. *Zamarada clenchi*, genitalia (A.S.). 337, ♂; 338, aedeagus.

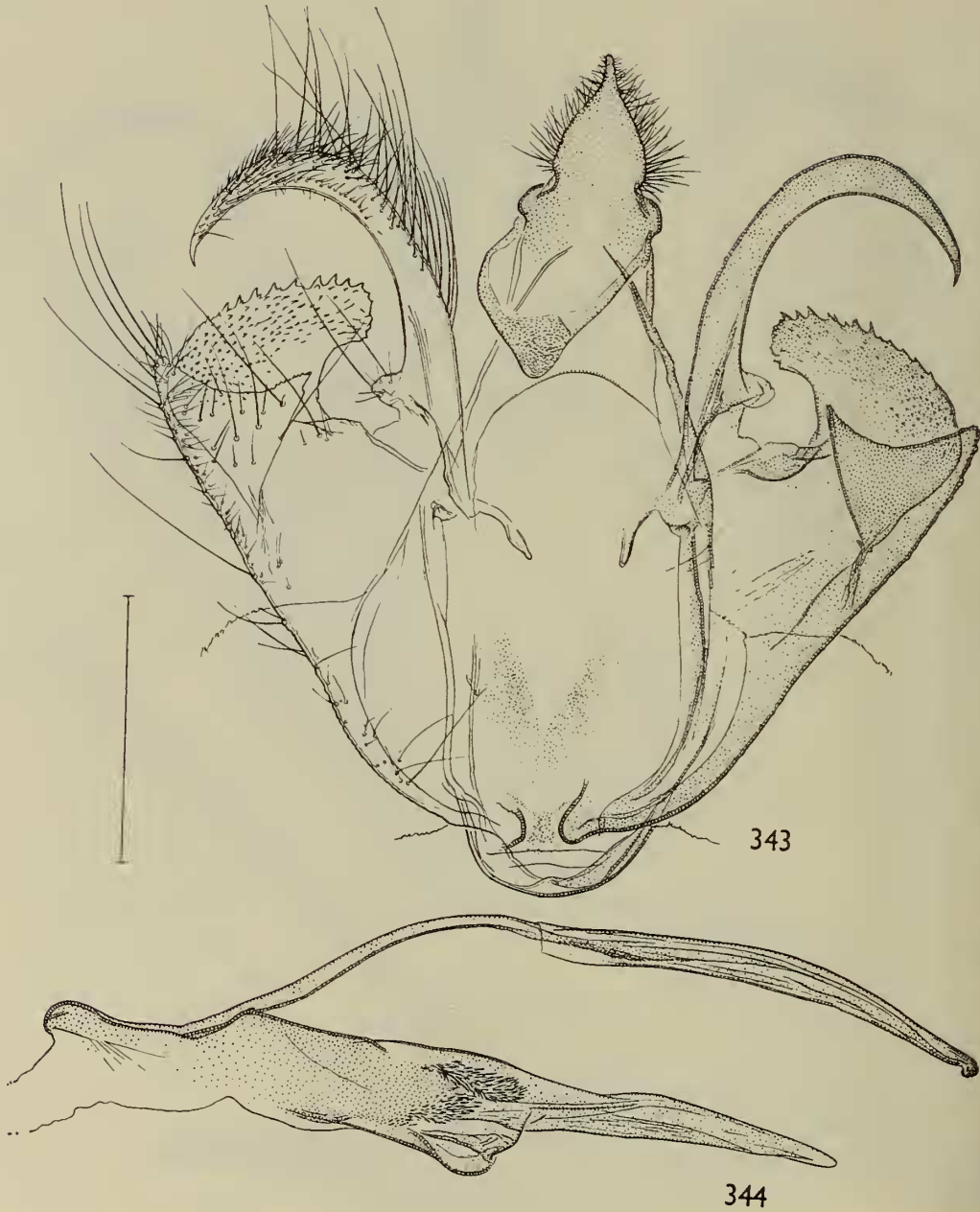




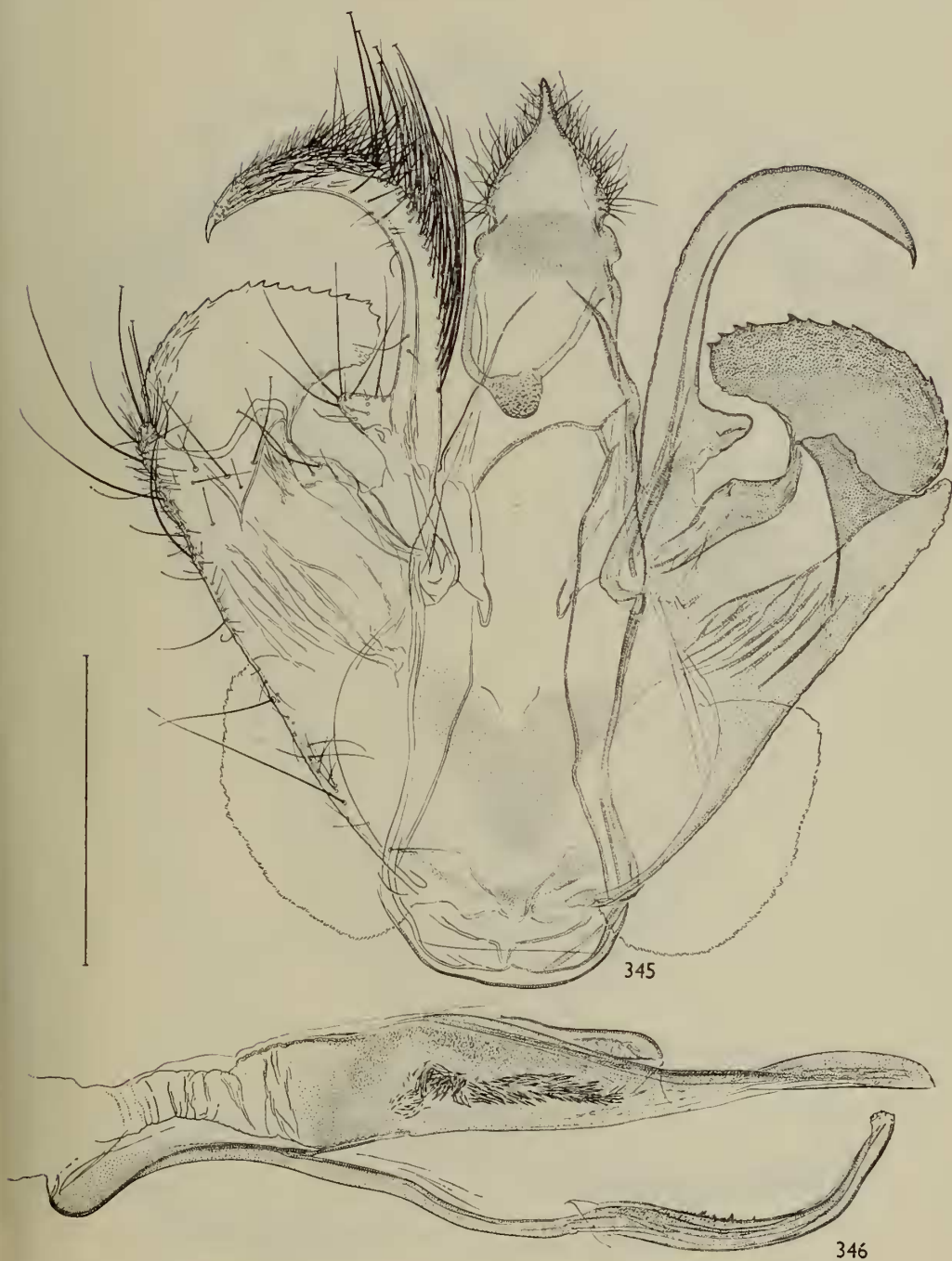
FIGS 339, 340. *Zamarada acrochra*, genitalia (A.S.). 339, ♂; 340, aedeagus.



FIGS 341, 342. *Zamarada auratisquama*, genitalia (A.S.). 341, ♂; 342, aedeagus.

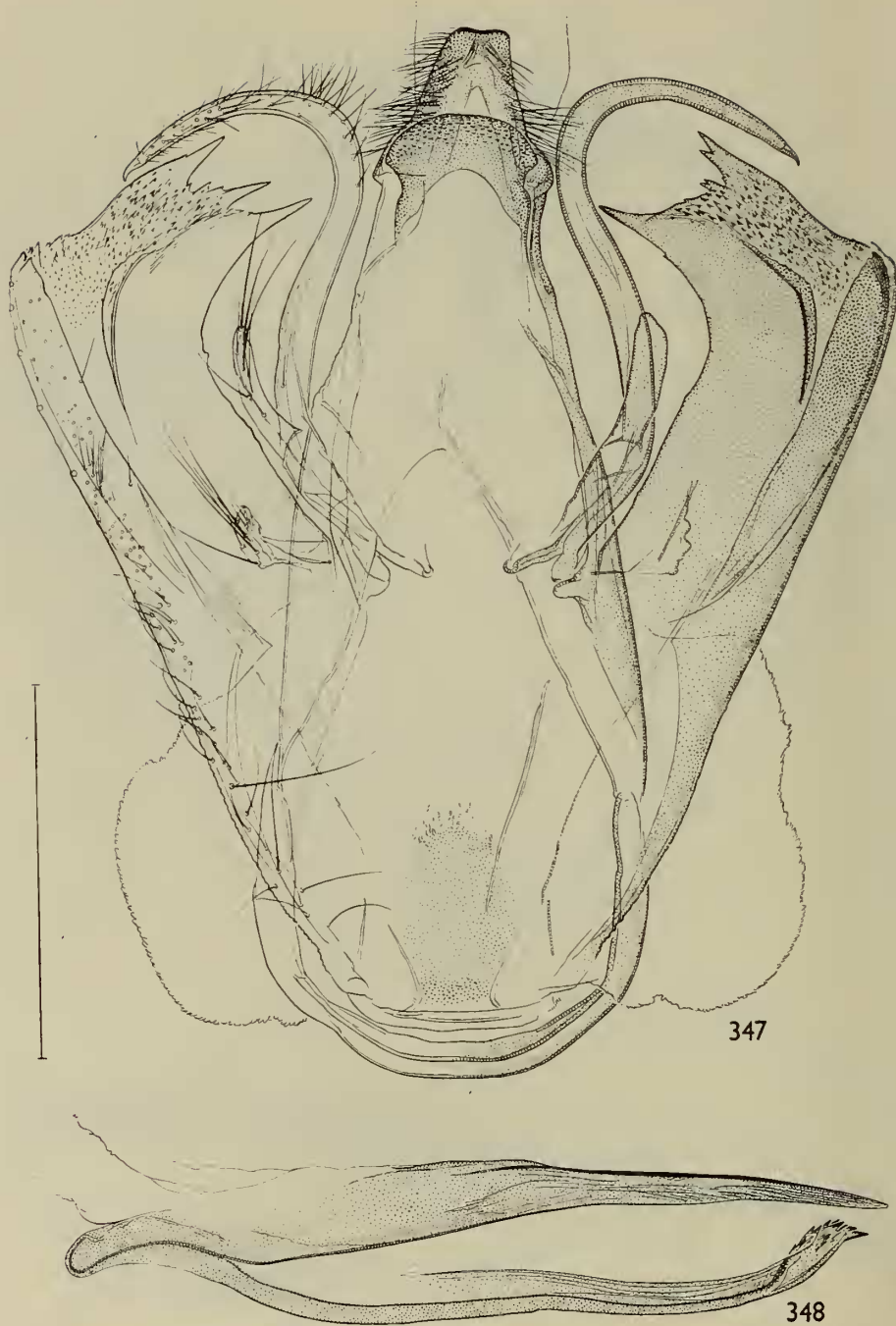


FIGS 343, 344. *Zamarada corroborata*, genitalia (A.S.). 343, ♂; 344, aedeagus.

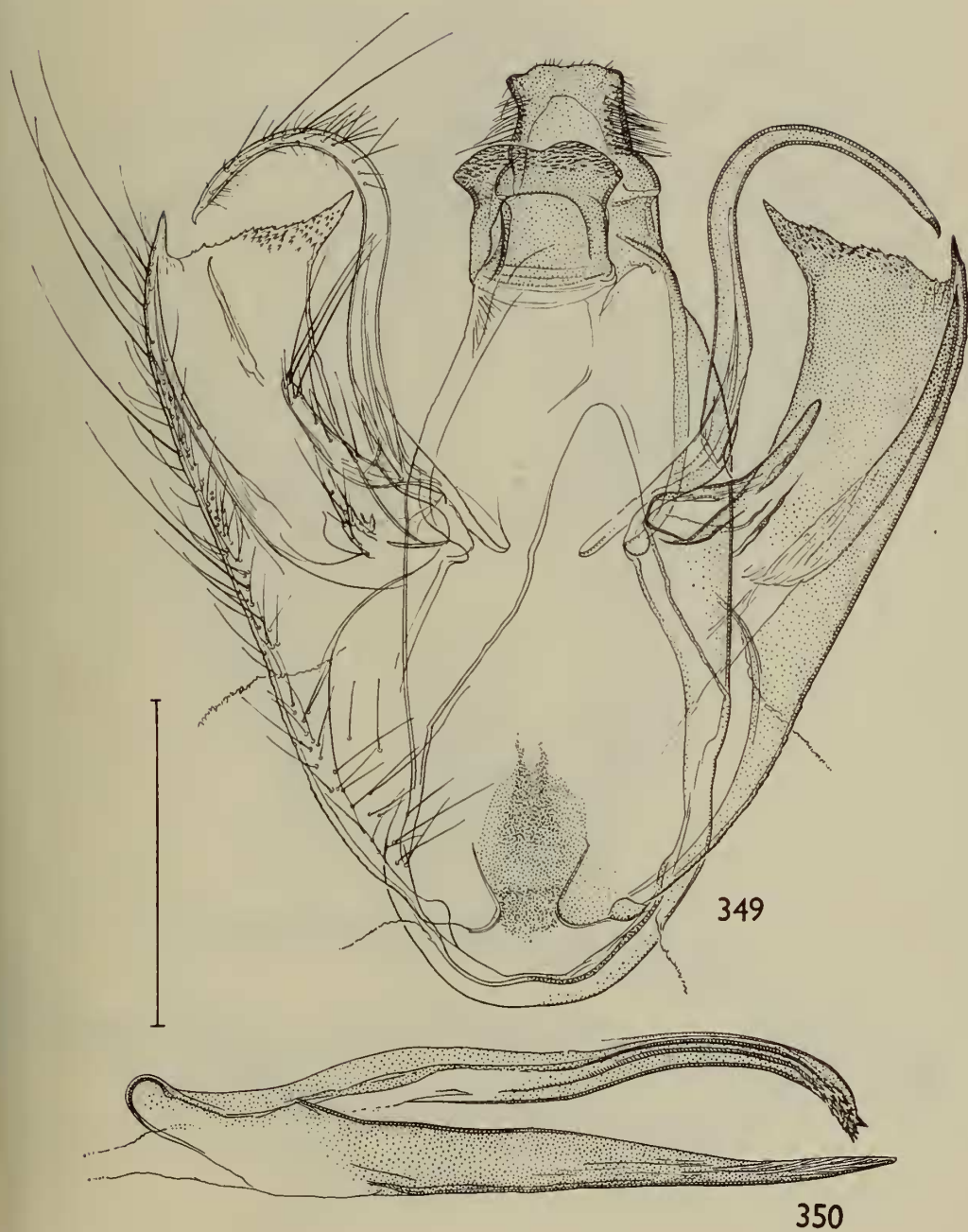


FIGS 345, 346. *Zamarada undimarginata*, genitalia (A.S.). 345, ♂; 346, aedeagus.





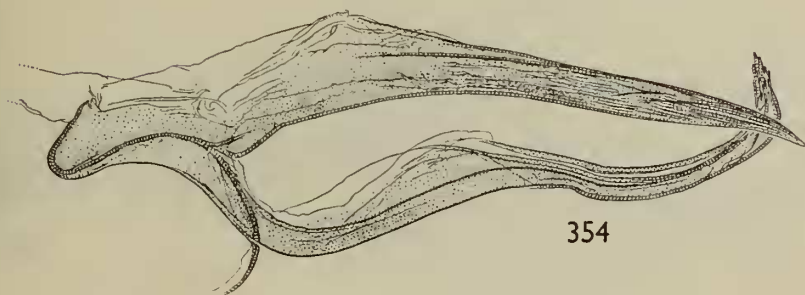
FIGS 347, 348. *Zamarada principis*, genitalia (A.S.). 347, ♂; 348, aedeagus.



FIGS 349, 350. *Zamarada platycephala*, genitalia (A.S.). 349, ♂; 350, aedeagus.



FIGS 351, 352. *Zamarada tricuspida*, genitalia (A.S.). 351, ♂; 352, aedeagus.



FIGS 353, 354. *Zamarada clavigera*, genitalia (A.S.). 353, ♂; 354, aedeagus.



FIGS 355, 356. *Zamarada bilobata*, genitalia (A.S.). 355, ♂; 356, aedeagus.





FIGS 357, 358. *Zamarada bicuspidata*, genitalia (A.S.) 357, ♂; 358, aedeagus.

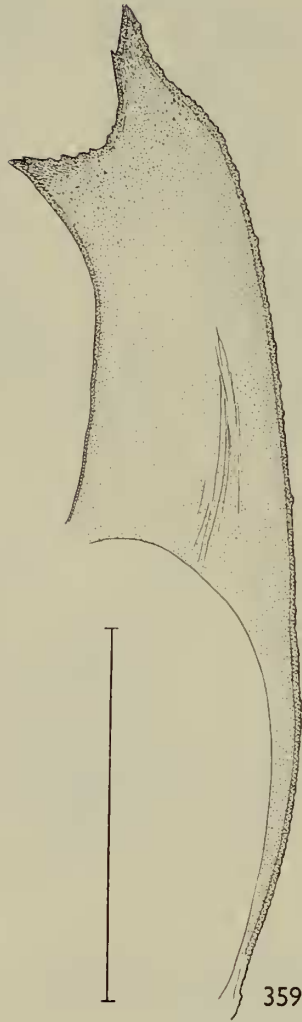
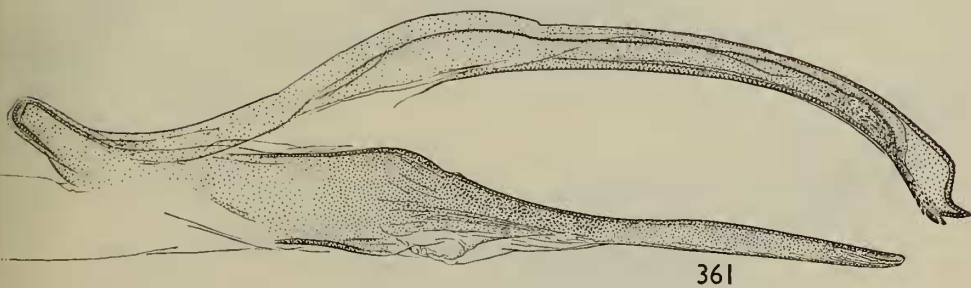
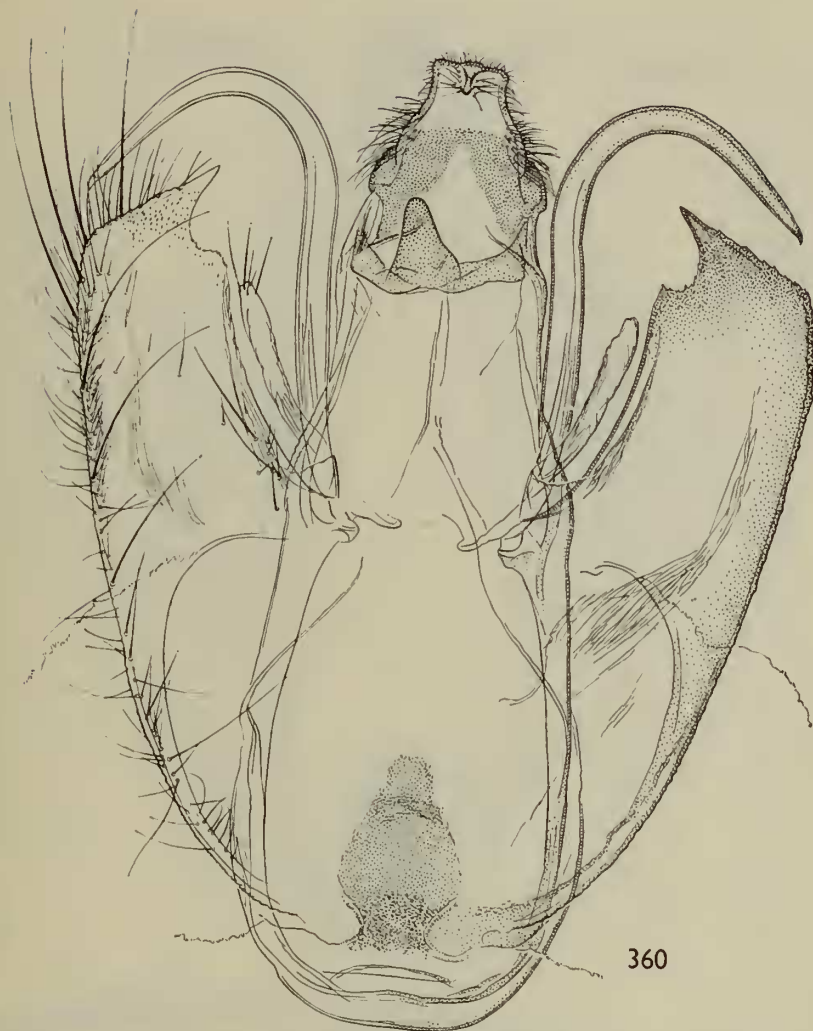


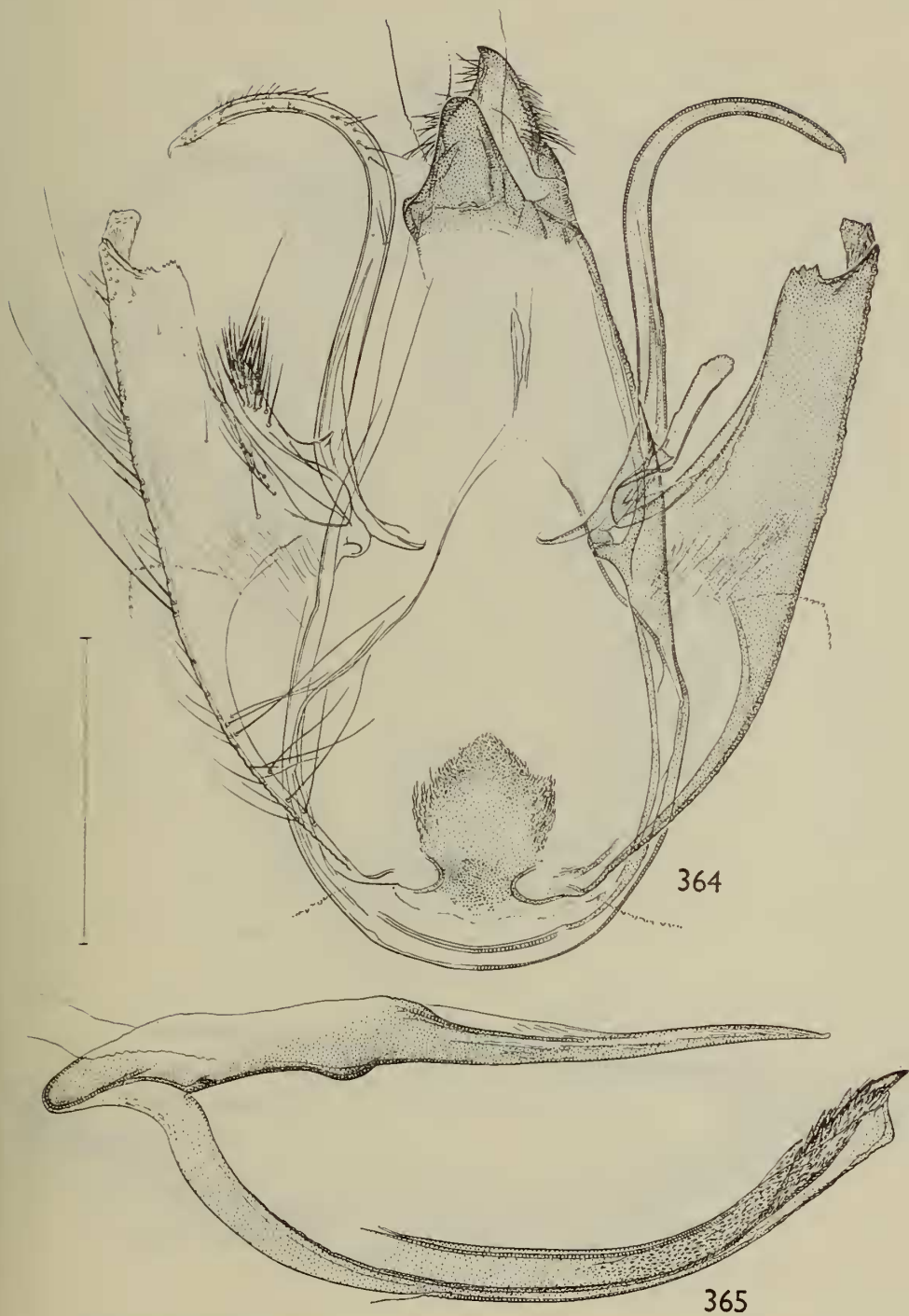
FIG. 359. *Zamarada bicuspidata*, right valve (A.S.).



FIGS 360, 361. *Zamarada consummata*, genitalia (A.S.). 360, ♂; 361, aedeagus.



FIGS 362, 363. *Zamarada onycha*, genitalia (A.S.). 362, ♂; 363, aedeagus.

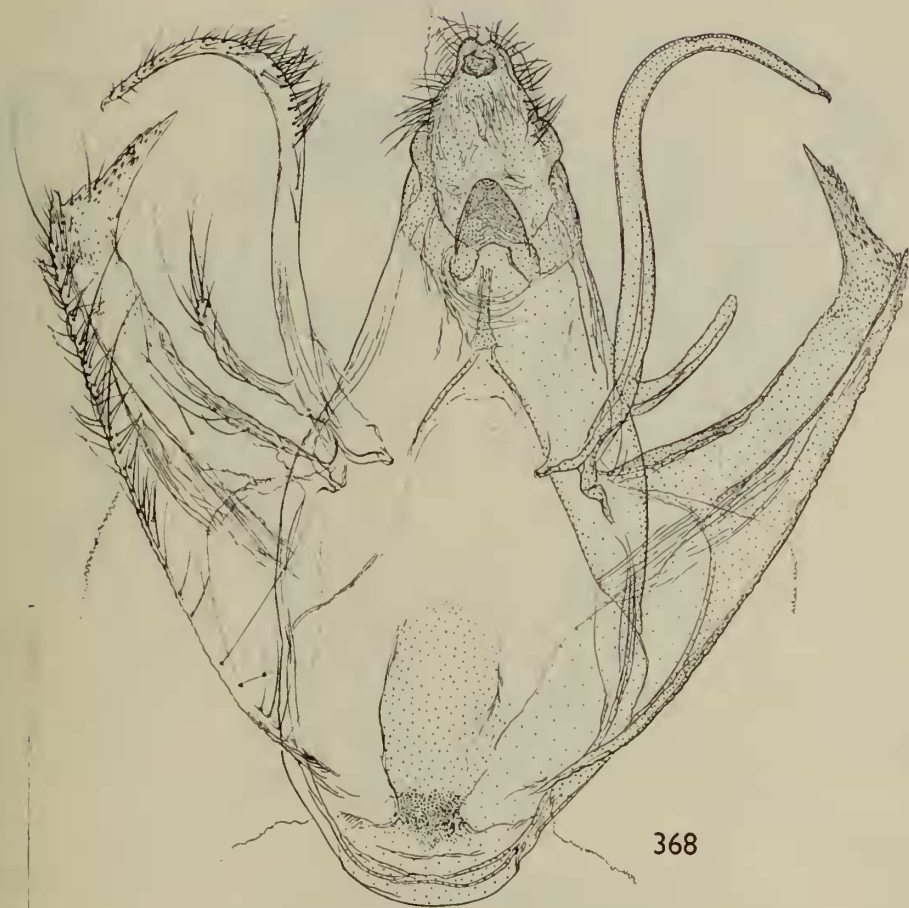


FIGS 364, 365. *Zamarada rupta*, genitalia (A.S.). 364, ♂; 365, aedeagus.

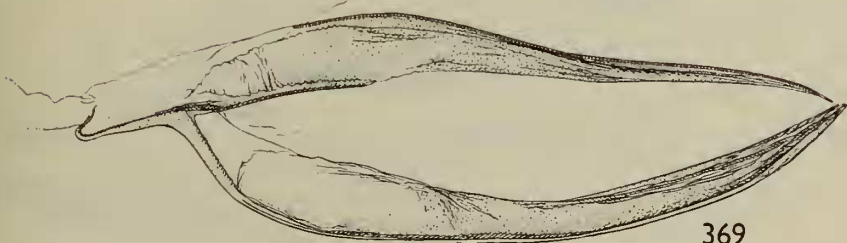




FIGS 366, 367. *Zamarada merga*, genitalia (A.S.). 366, ♂; 367, aedeagus.

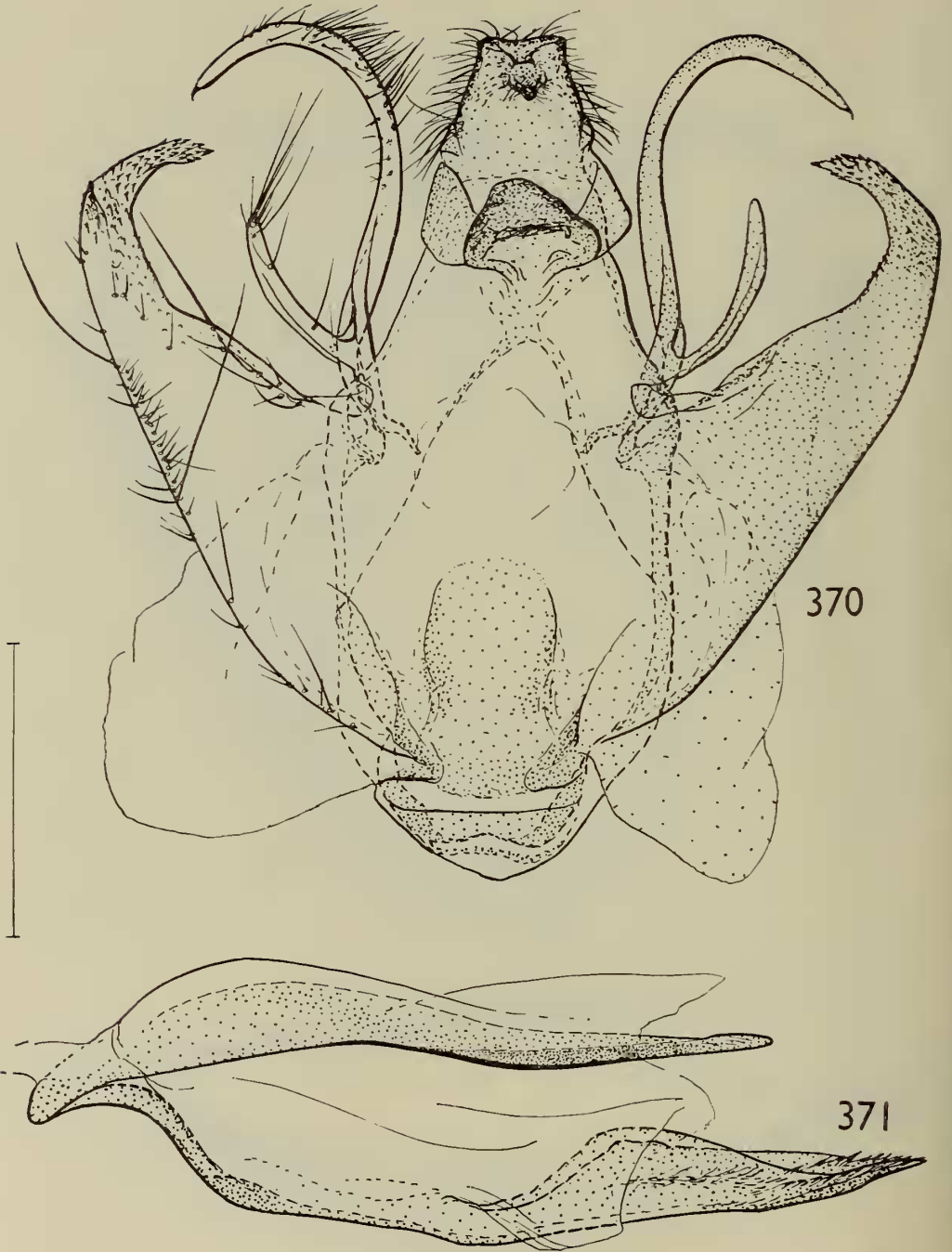


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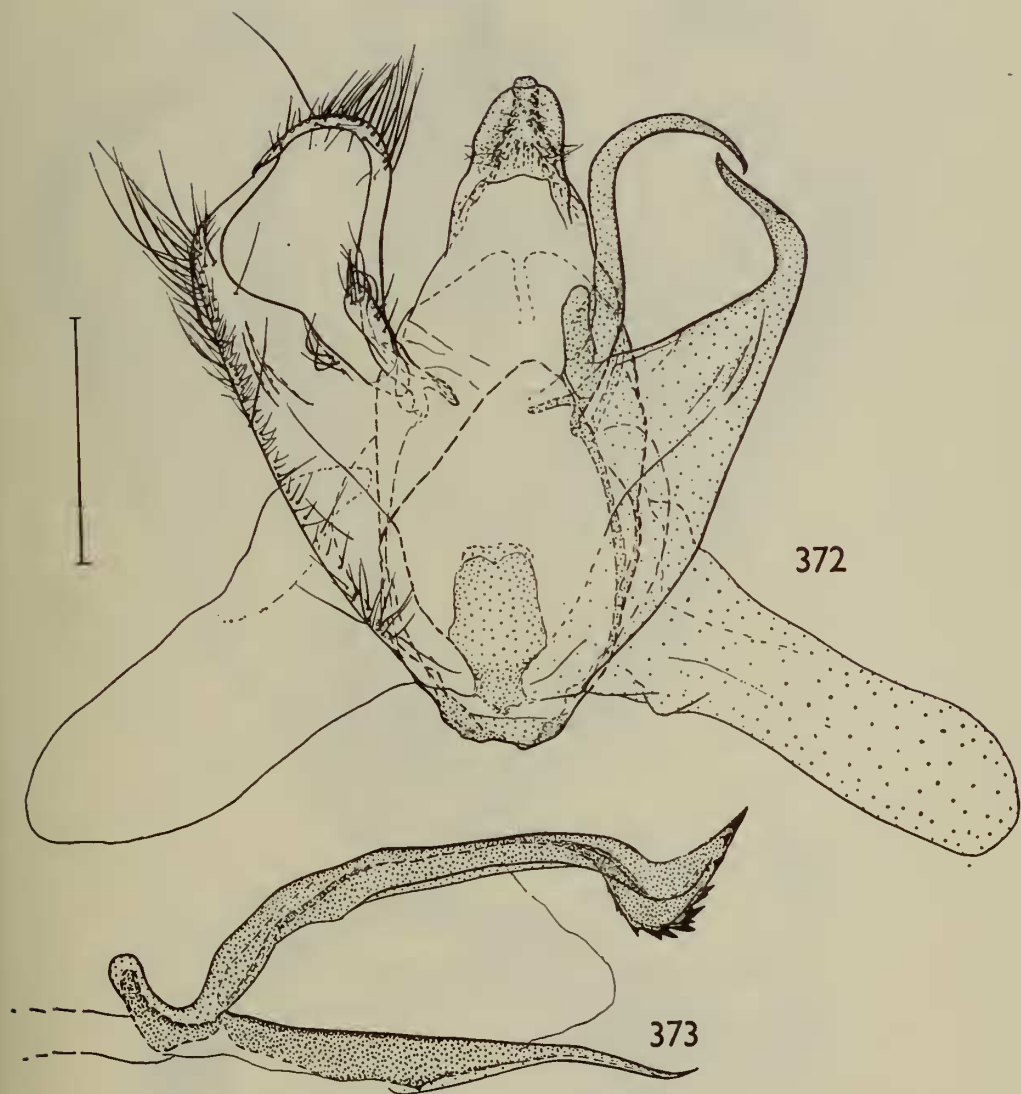


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FIGS 368, 369. *Zamarada lima*, genitalia (A.S.). 368, ♂; 369, aedeagus.



FIGS 370, 371. *Zamarada gamma*, genitalia (J.A.). 370, ♂; 371, aedeagus.

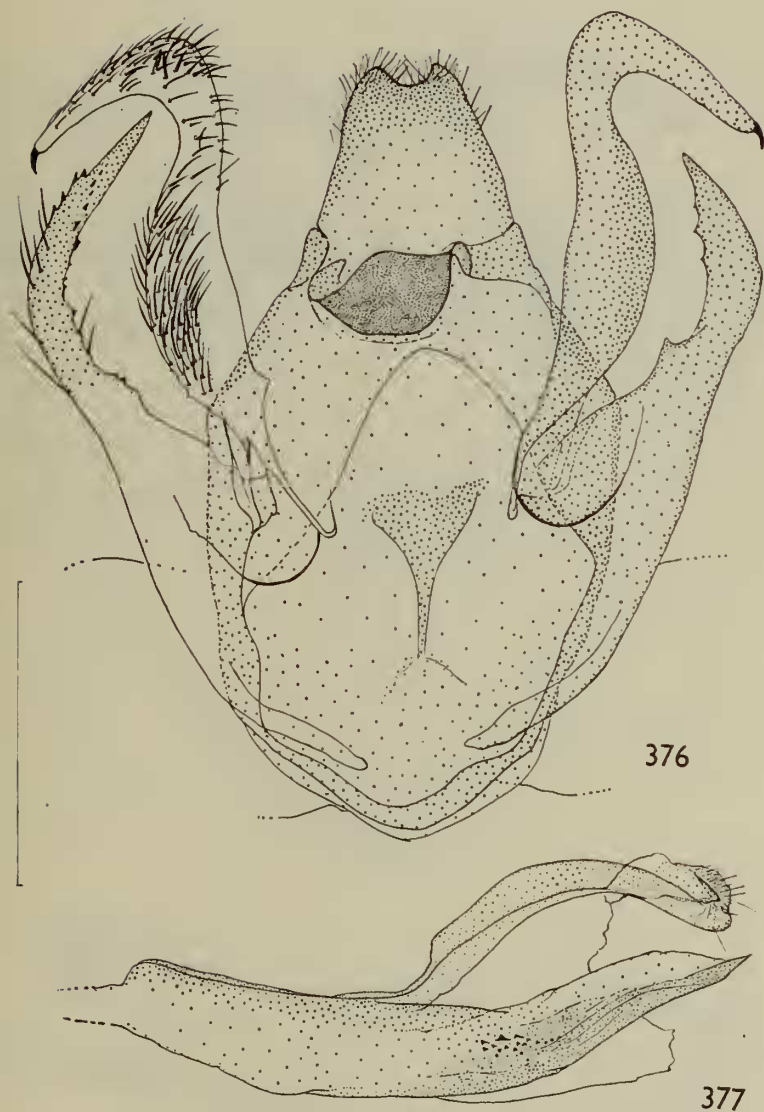


FIGS 372, 373. *Zamarada subincoloris*, genitalia (J.A.). 372, ♂; 373, aedeagus.

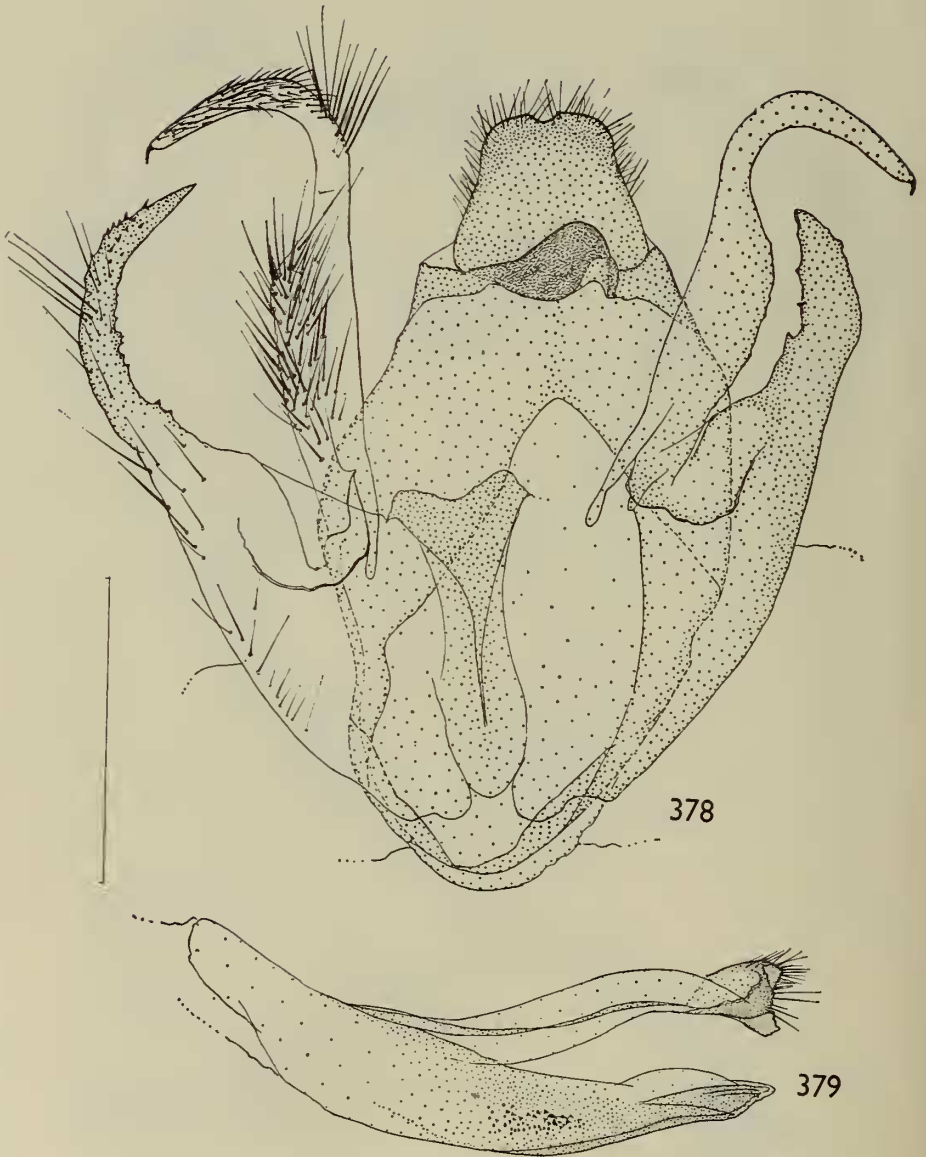


FIGS 374, 375. *Zamarada xyle*, genitalia (A.S.). 374, ♂; 375, aedeagus.

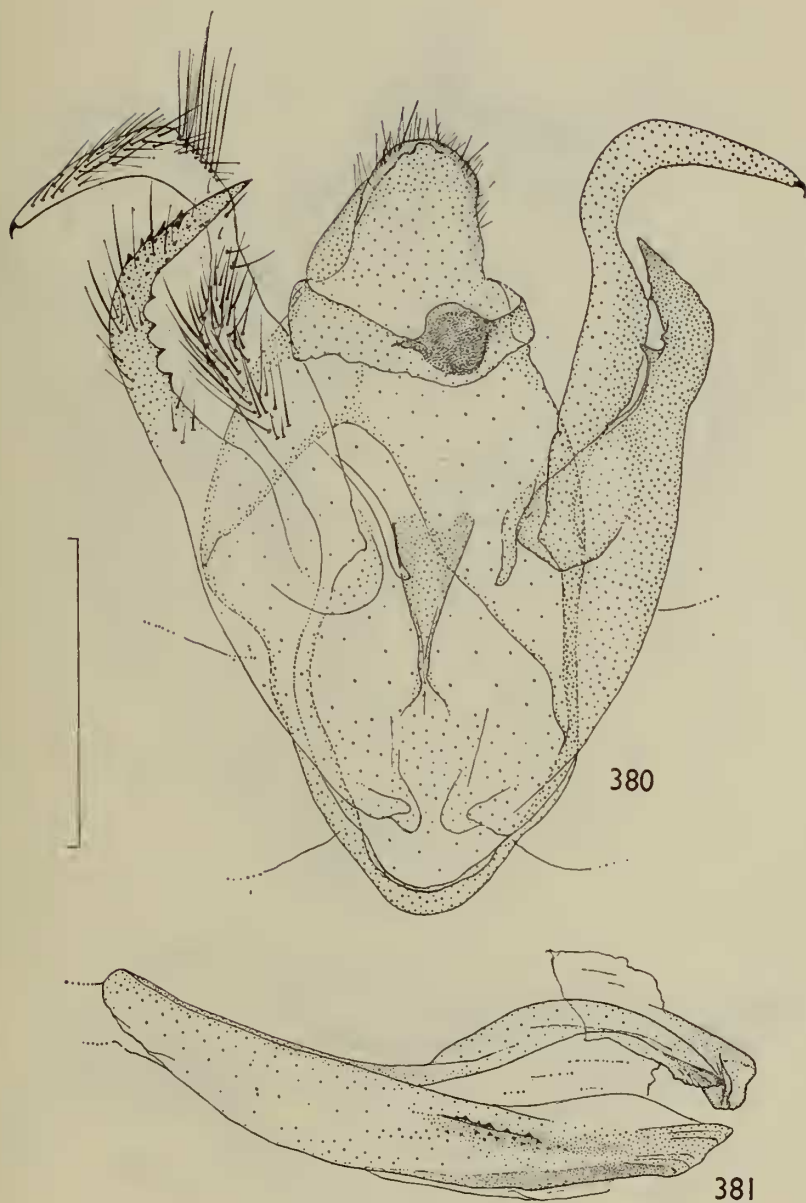




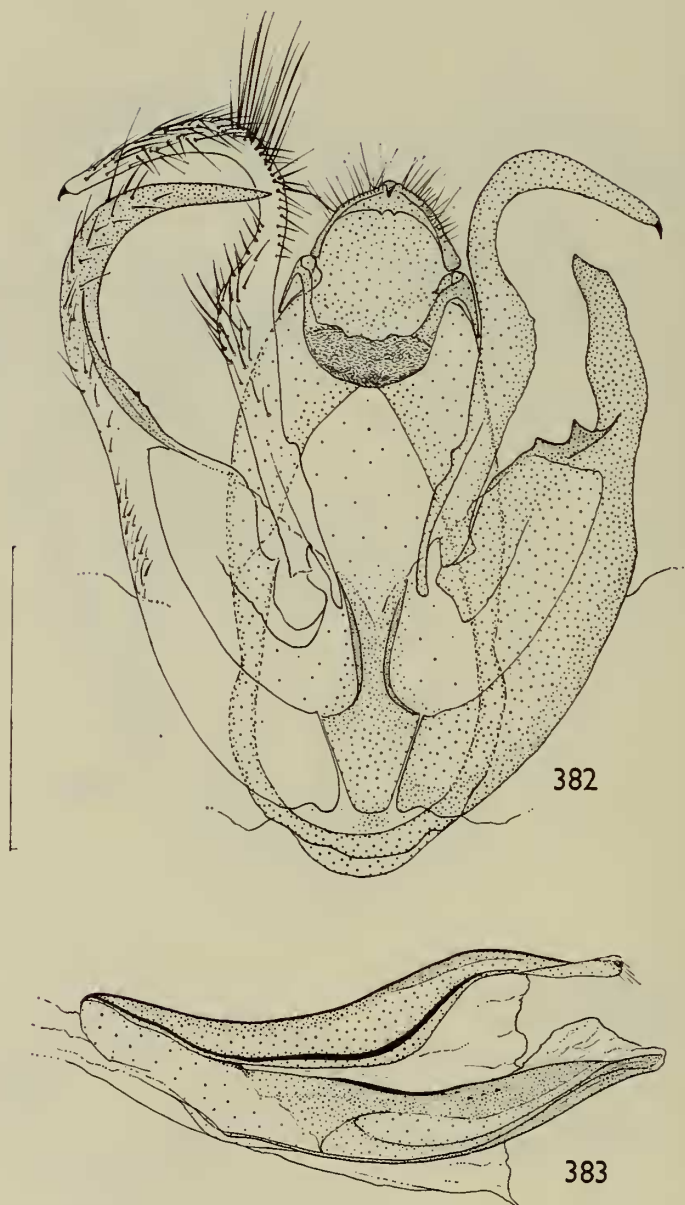
FIGS 376, 377. *Zamarada clio*, genitalia (D.F.). 376, ♂; 377, aedeagus.



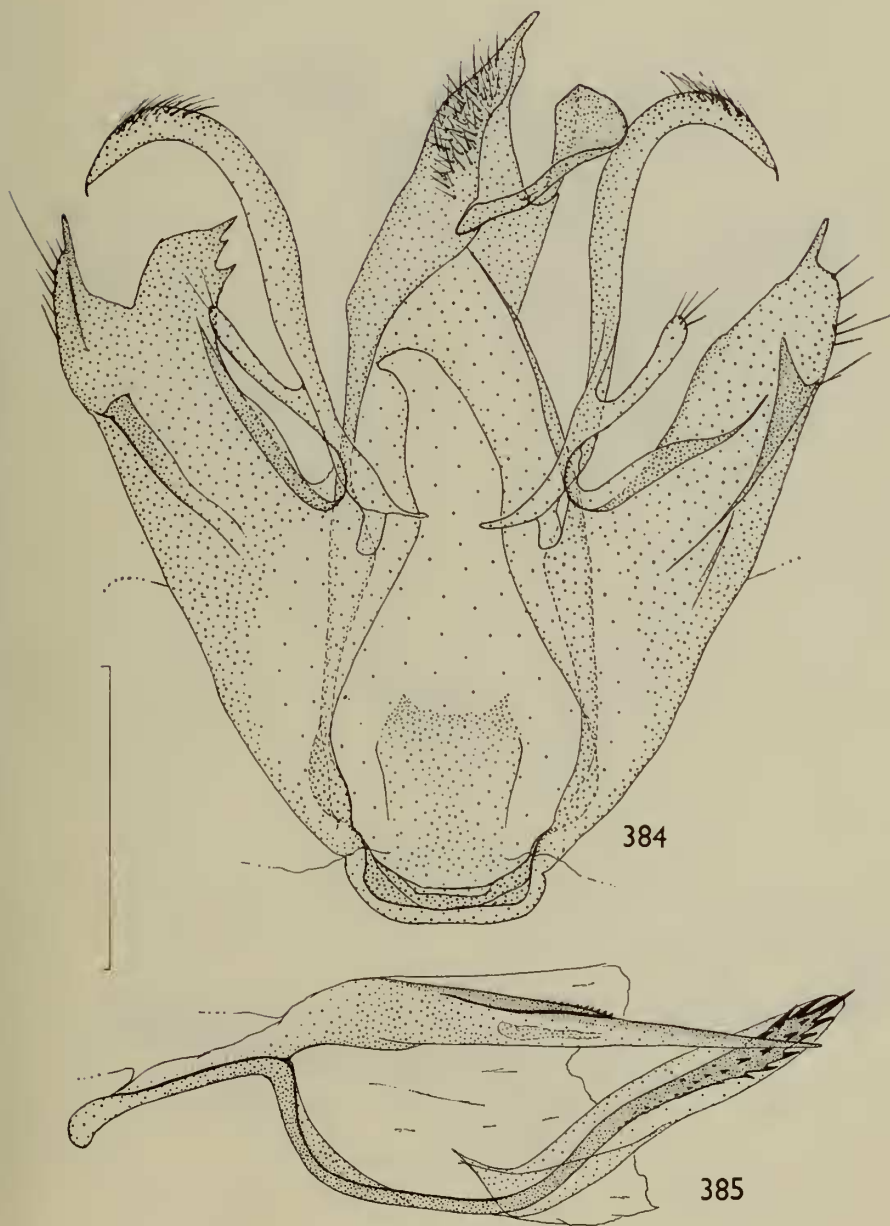
FIGS 378, 379. *Zamarada aurolineata*, genitalia (D.F.). 378, ♂; 379, aedeagus.



FIGS 380, 381. *Zamarada aerata*, genitalia (D.F.). 380, ♂; 381, aedeagus.

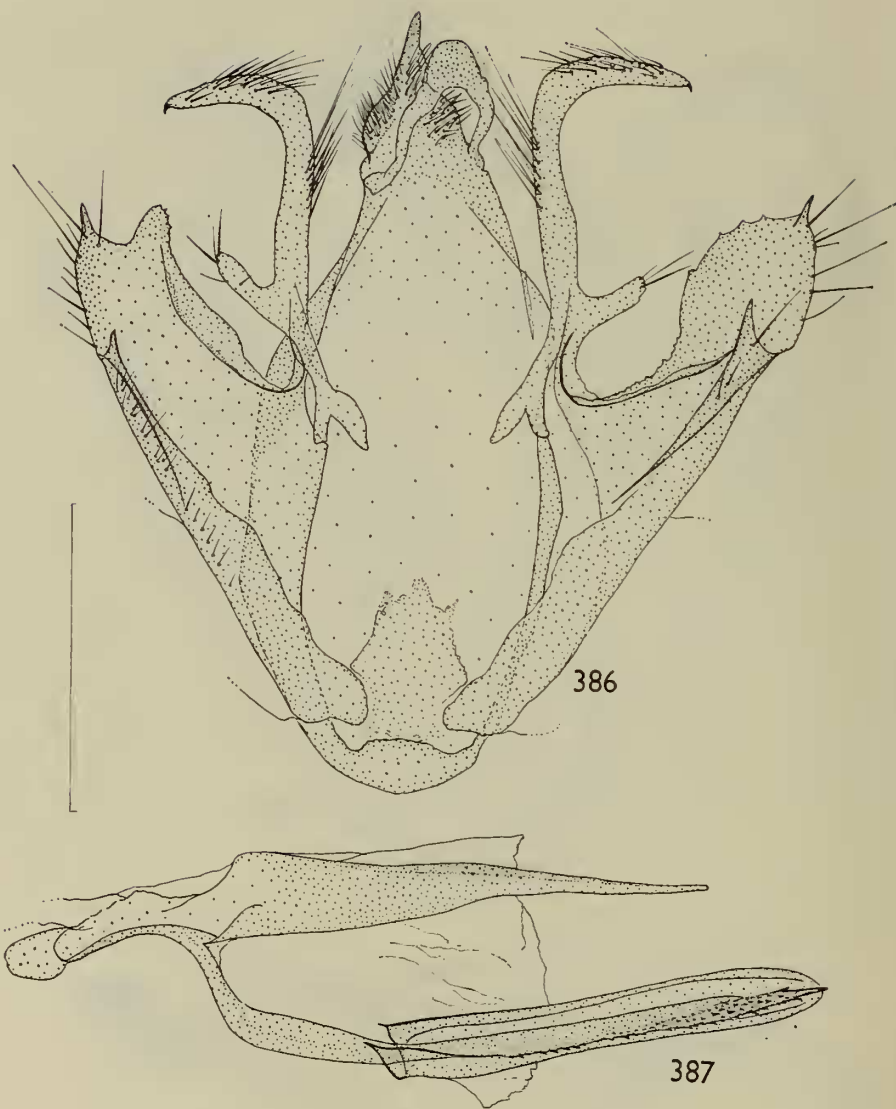


FIGS 382, 383. *Zamarada herbuloti*, genitalia (D.F.). 382, ♂; 383, aedeagus.

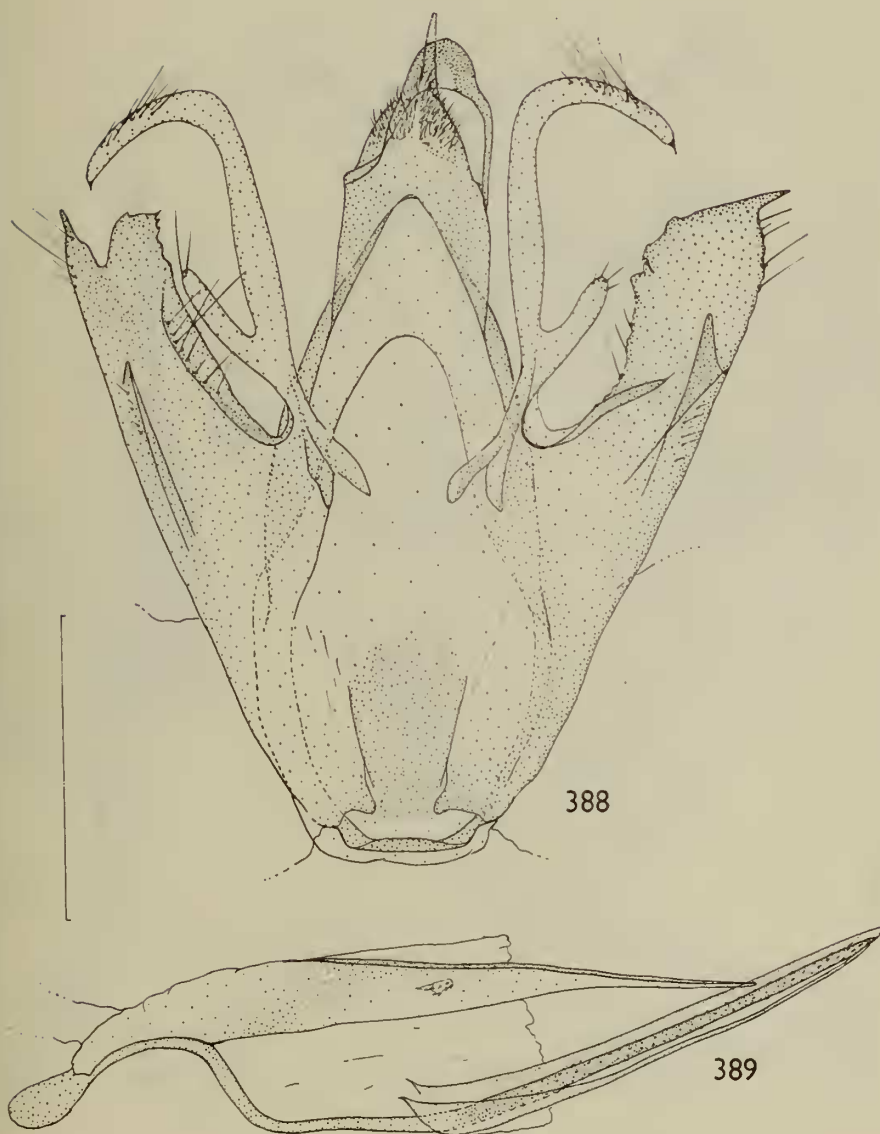


FIGS 384, 385. *Zamarada bonaberiensis*, genitalia (D.F.). 384, ♂; 385, aedeagus.

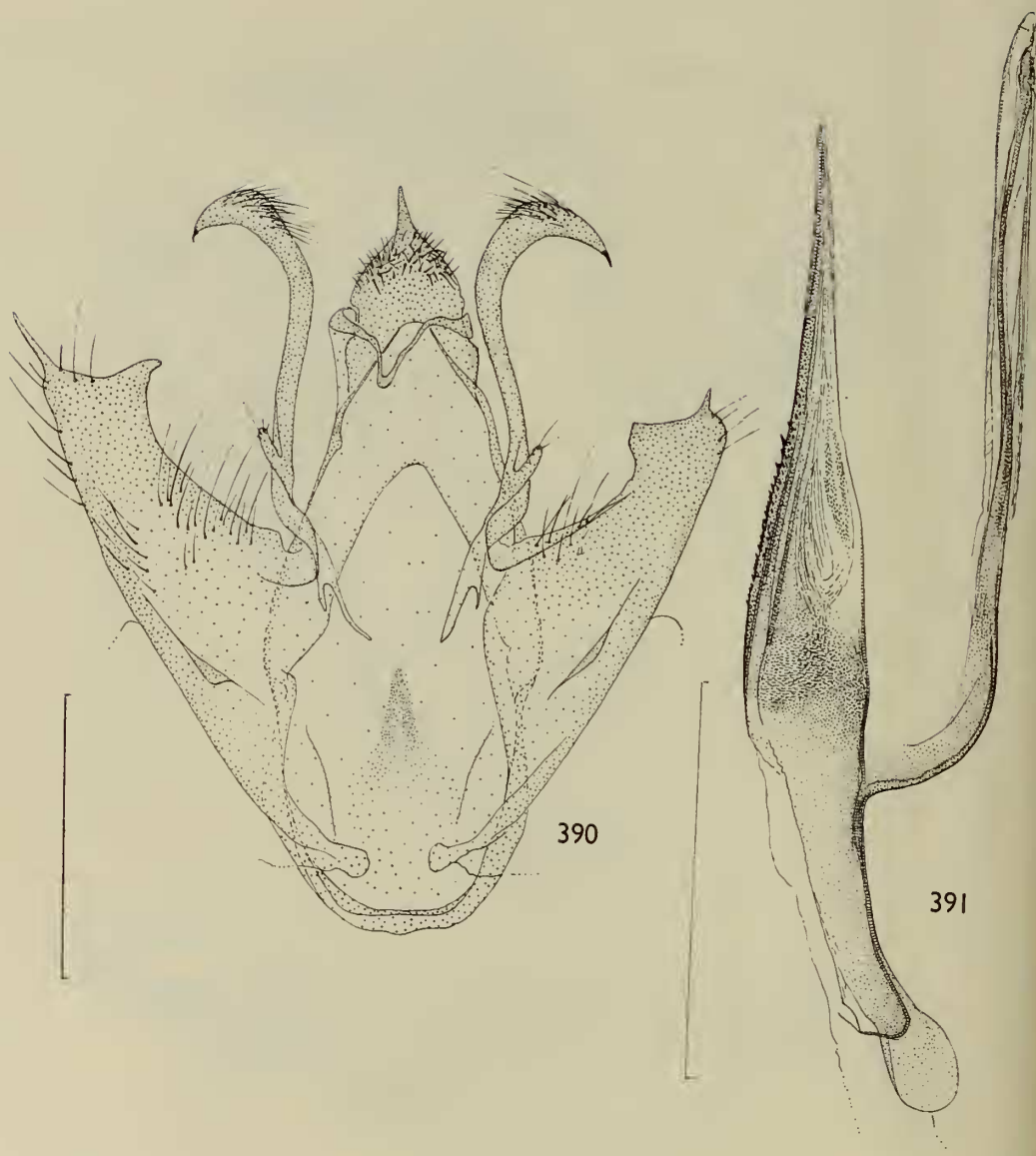




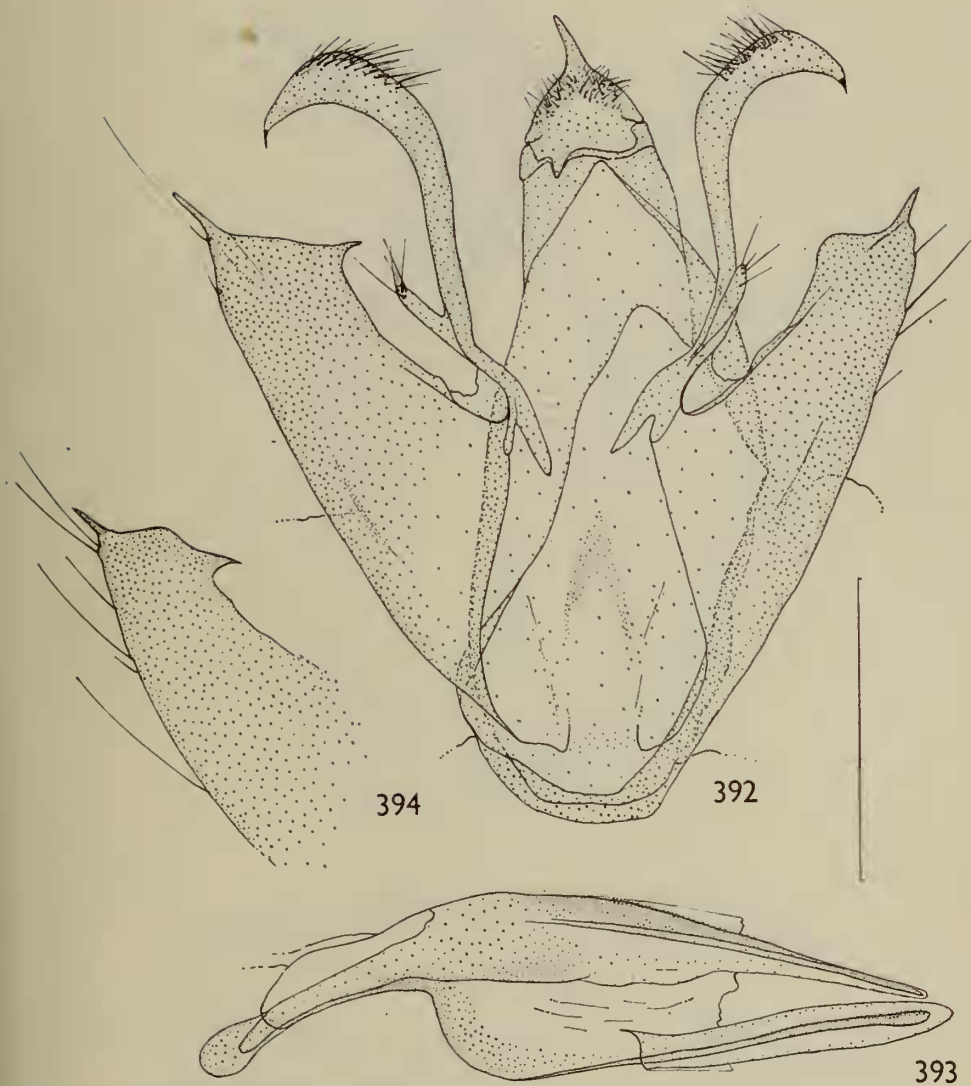
FIGS 386, 387. *Zamarada collarti*, genitalia (D.F.). 386, ♂; 387, aedeagus.



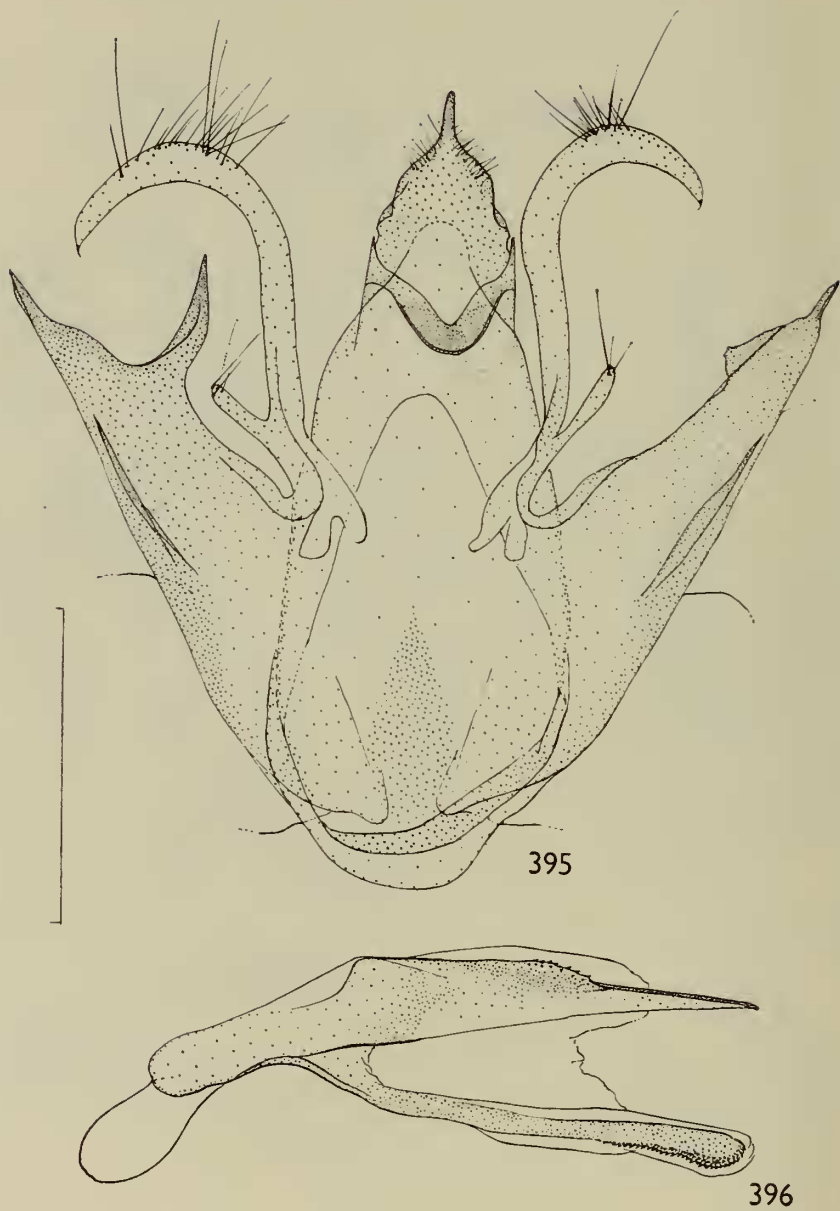
FIGS 388, 389. *Zamarada vigilans*, genitalia (D.F.). 388, ♂; 389, aedeagus.



FIGS 390, 391. *Zamarada perlepidata*, genitalia. 390, ♂ (D.F.); 391, aedeagus (A.S.).



FIGS 392-394. *Zamarada*, genitalia (D.F.). 392, 393, *terpsichore terpsichore*. 392, ♂; 393, aedeagus. 394, *terpsichore aprica*, left valve.



FIGS 395, 396. *Zamarada dolorosa*, genitalia (D.F.). 395, ♂; 396, aedeagus.





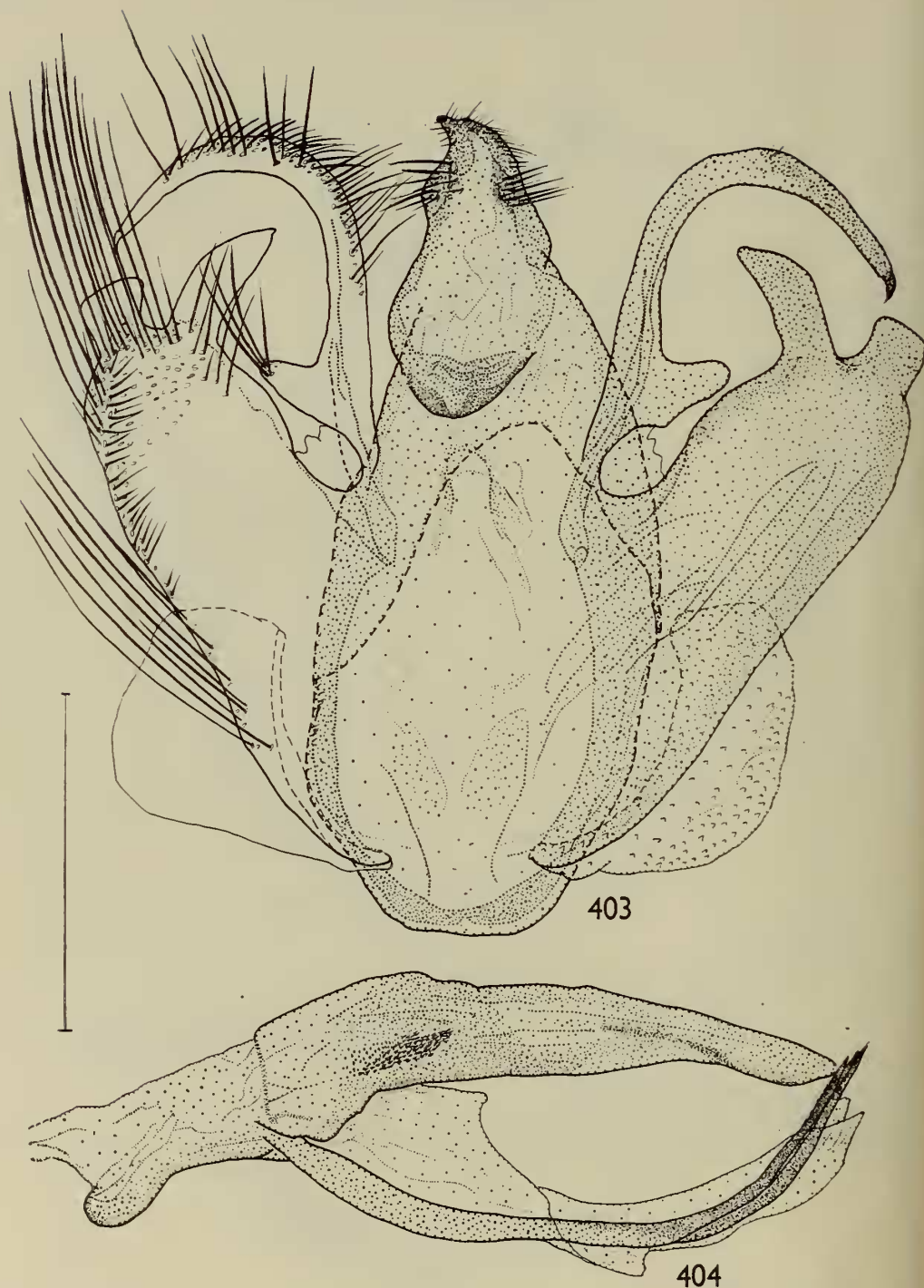
FIGS 397, 398. *Zamarada rhamphis*, genitalia (K.S.). 397, ♂; 398, aedeagus.



FIGS 399, 400. *Zamarada cucharita*, genitalia (K.S.). 399, ♂; 400, aedeagus.



FIGS 401, 402. *Zamarada reflexaria*, genitalia (K.S.). 401, ♂; 402, aedeagus.



FIGS 403, 404. *Zamarada ixiaria*, genitalia (K.S.). 403, ♂; 404, aedeagus.

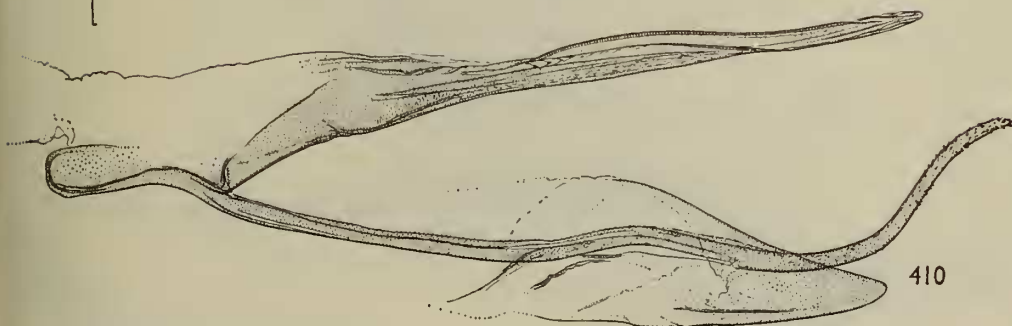


FIGS 405, 406. *Zamarada triangularis*, genitalia (K.S.). 405, ♂; 406, aedeagus.

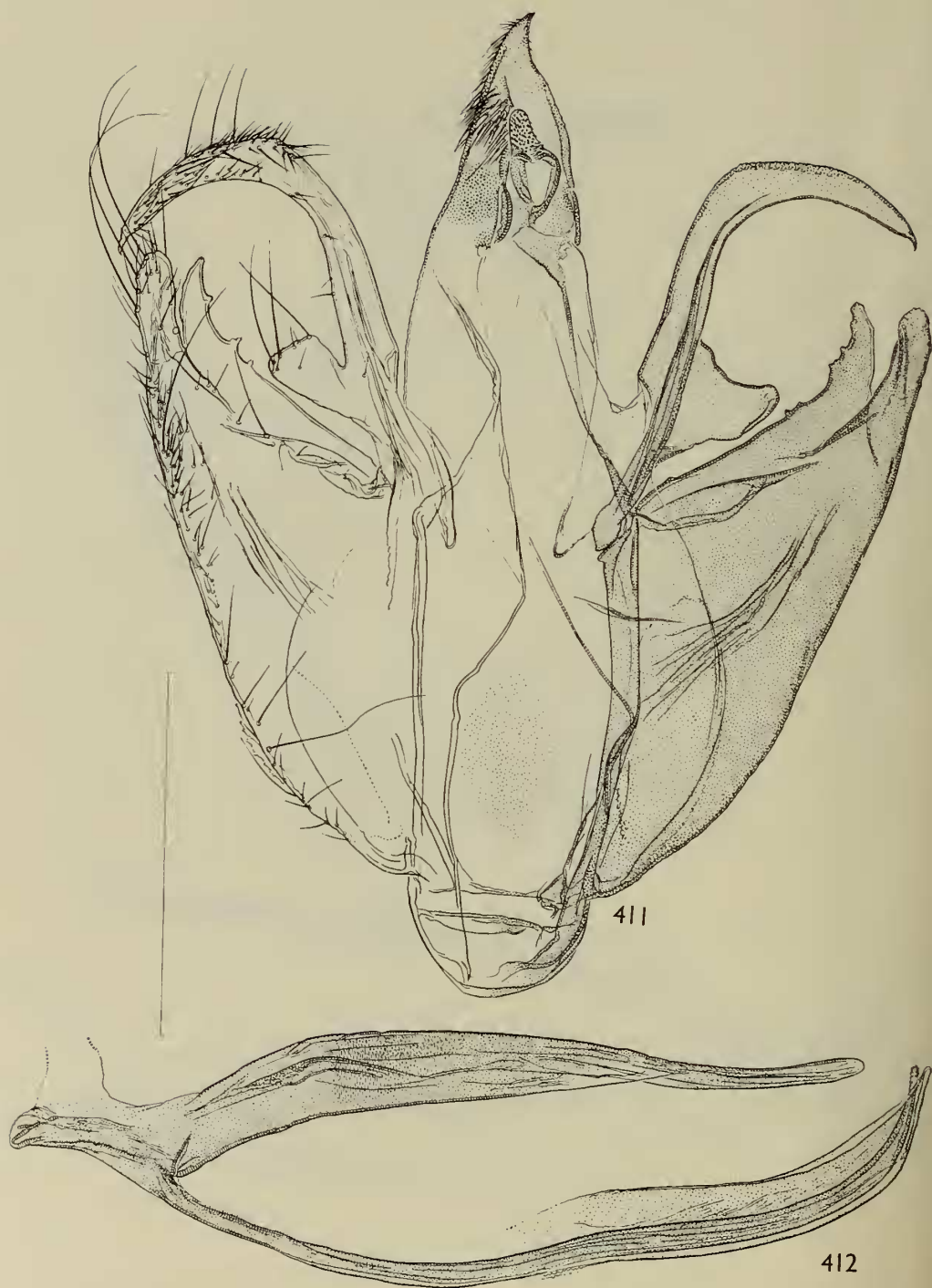




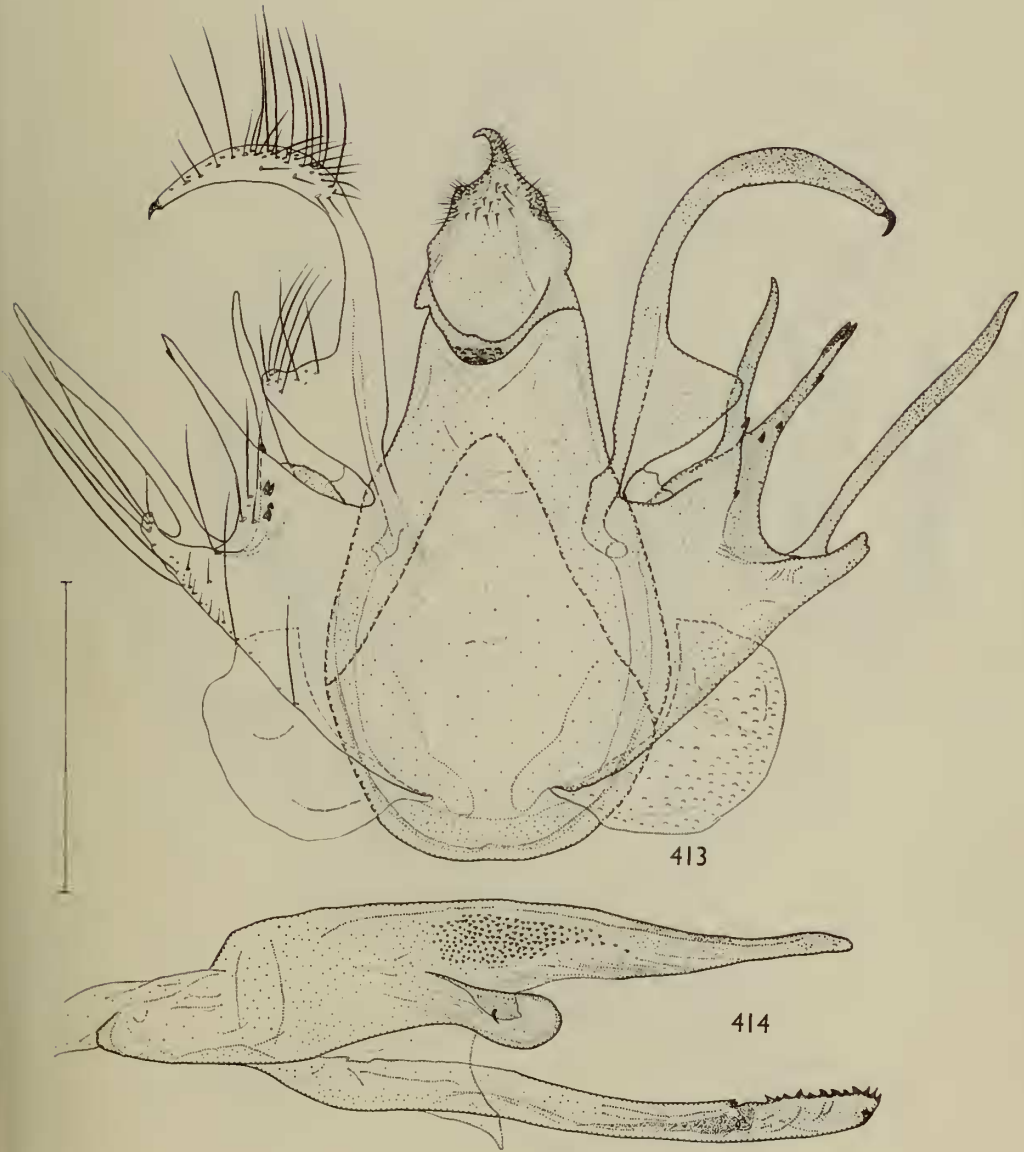
FIGS 407, 408. *Zamarada amymone*, genitalia (K.S.). 407, ♂; 408, aedeagus.



FIGS 409, 410. *Zamarada crenulata*, genitalia (A.S.). 409, ♂; 410, aedeagus.



FIGS 411, 412. *Zamaraea erosa*, genitalia (A.S.). 411, ♂; 412, aedeagus.



FIGS 413, 414. *Zamarada pristis*, genitalia (K.S.). 413, ♂; 414, aedeagus.

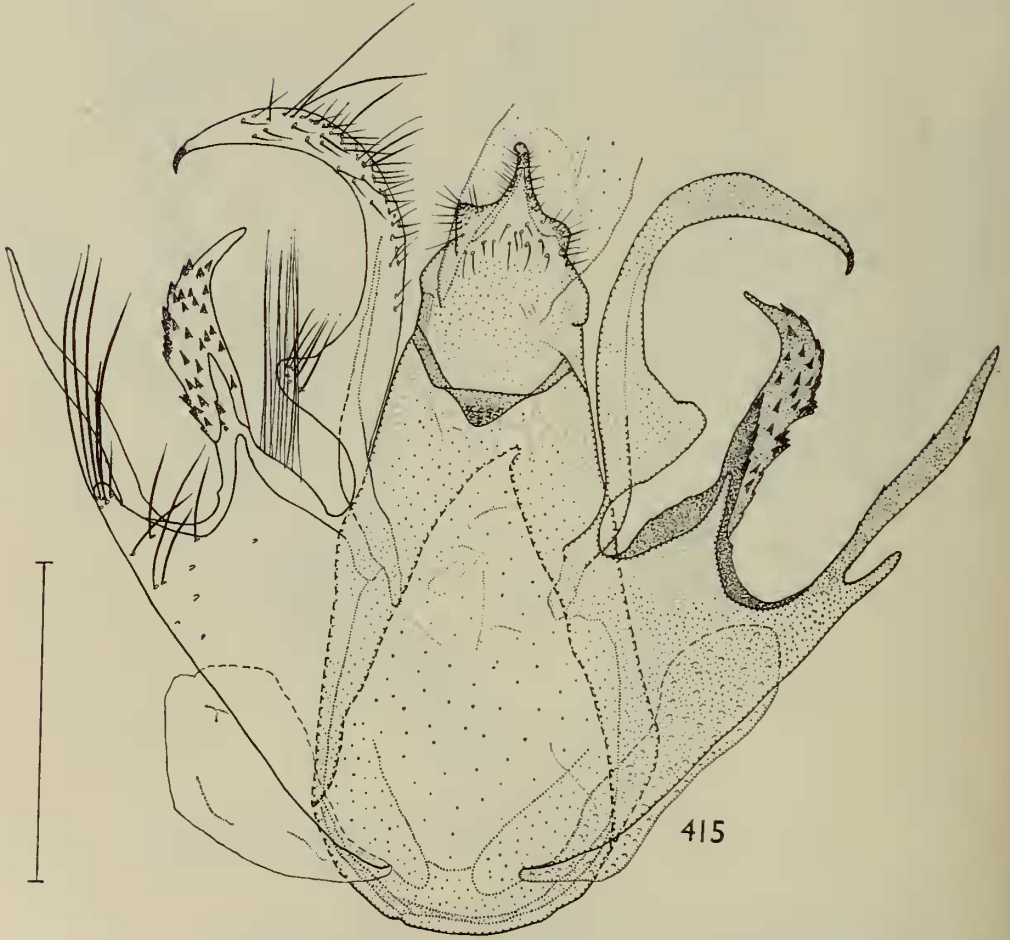
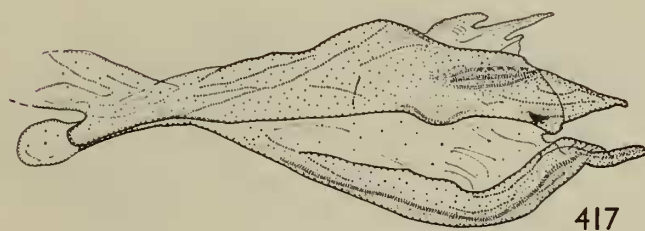
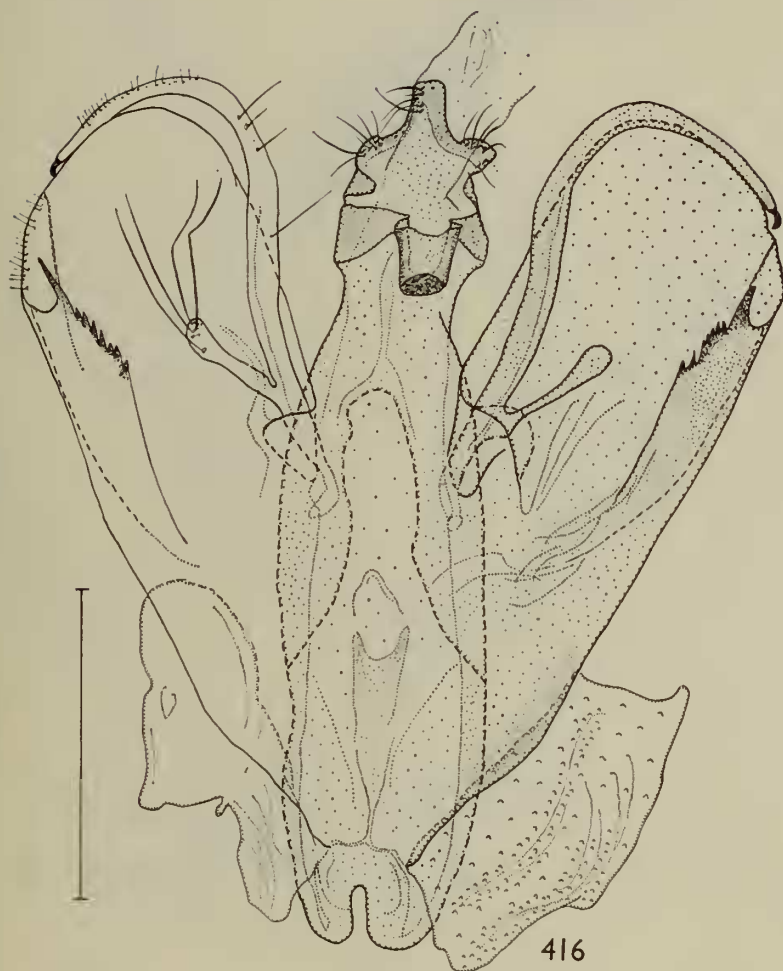
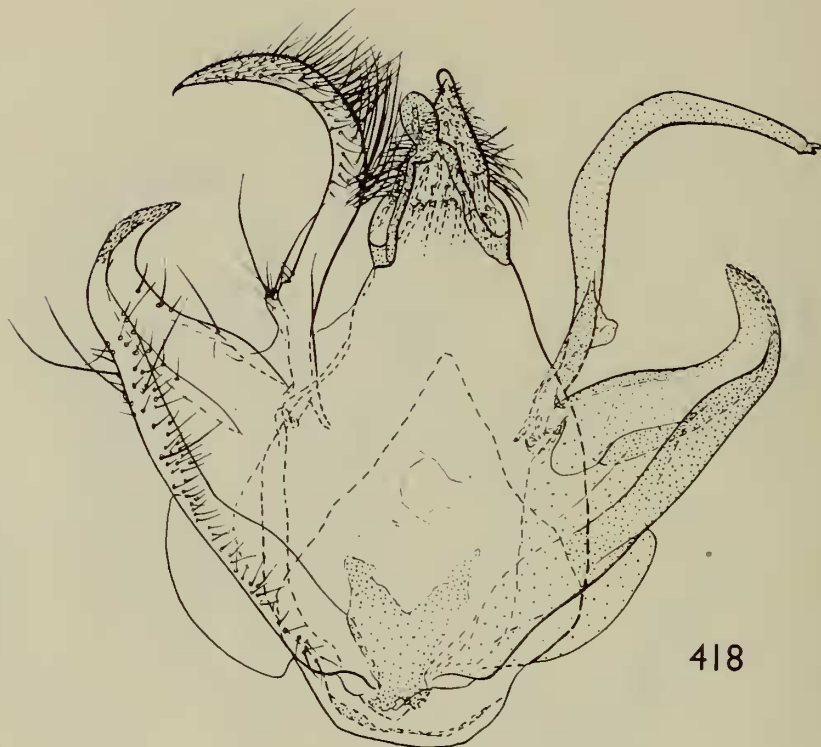


FIG. 415. *Zamarada anna*, ♂ genitalia (K.S.).

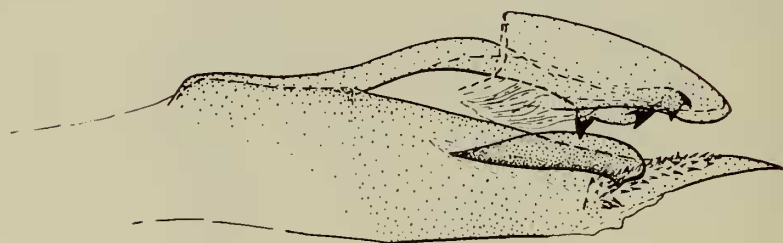




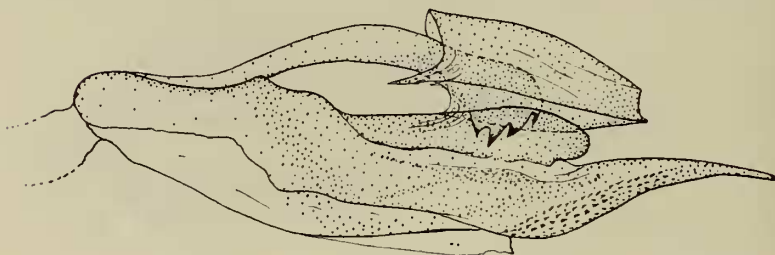
FIGS 416, 417. *Zamarada crystallophana*, genitalia (K.S.). 416, ♂; 417, aedeagus.



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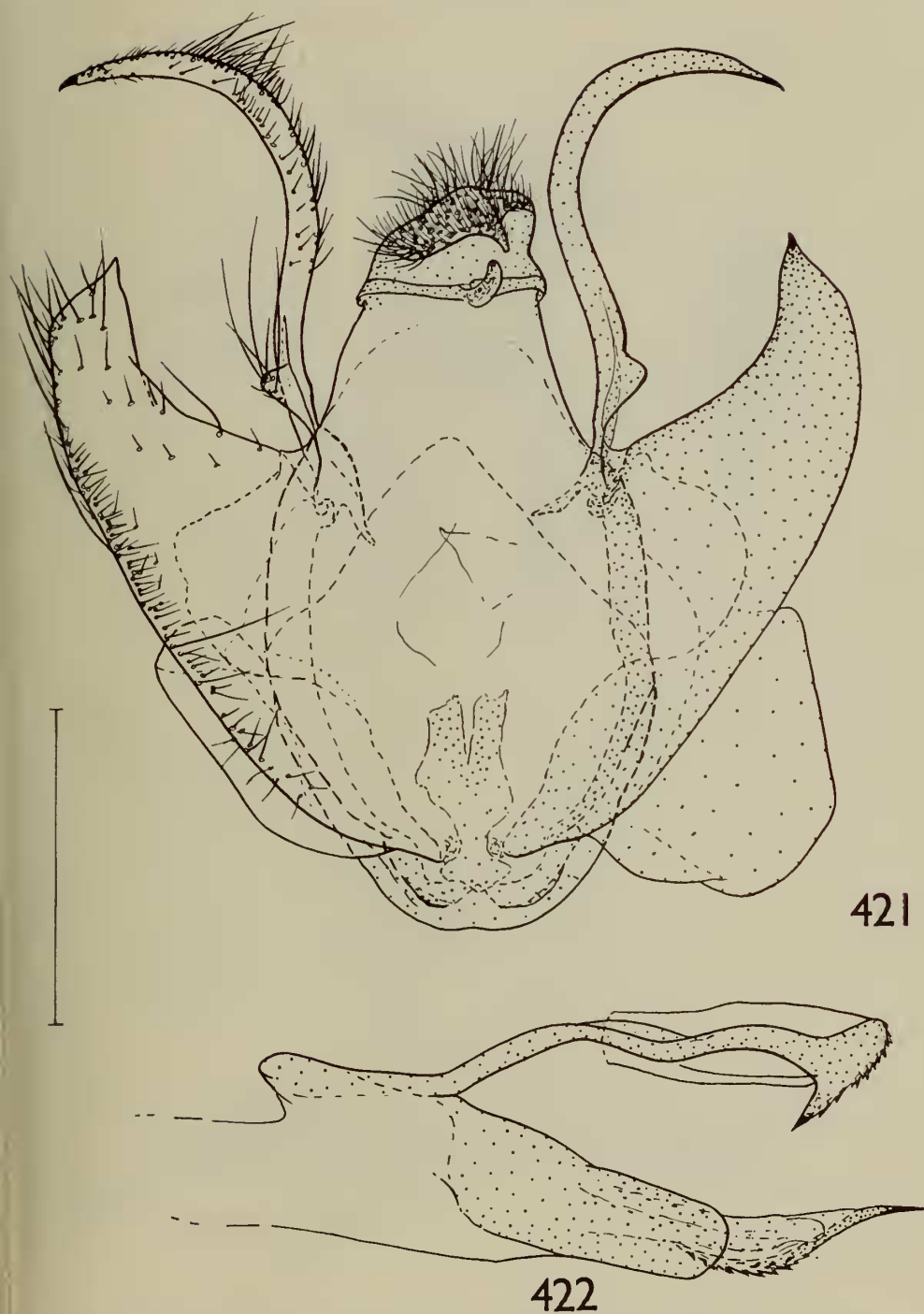


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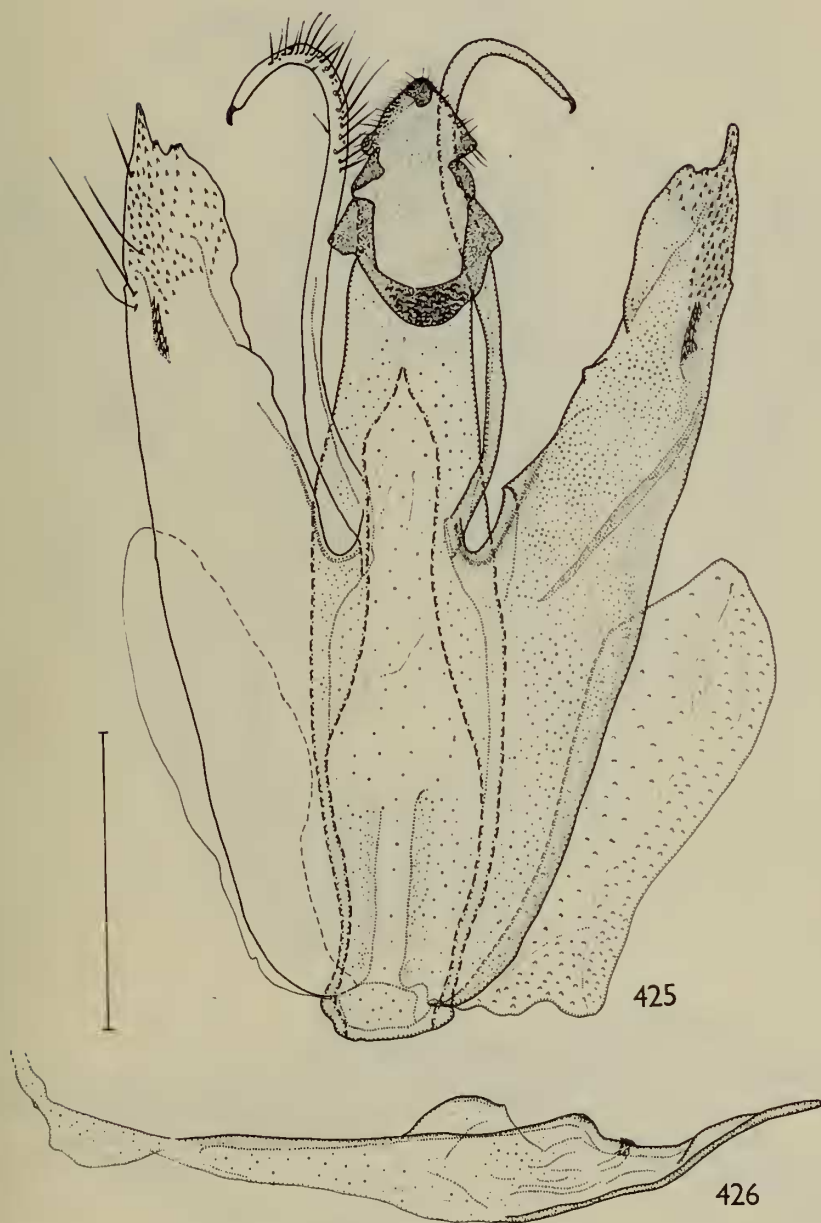
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FIGS 421, 422. *Zamarada leona*, genitalia (J.A.). 421, ♂; 422, aedeagus.

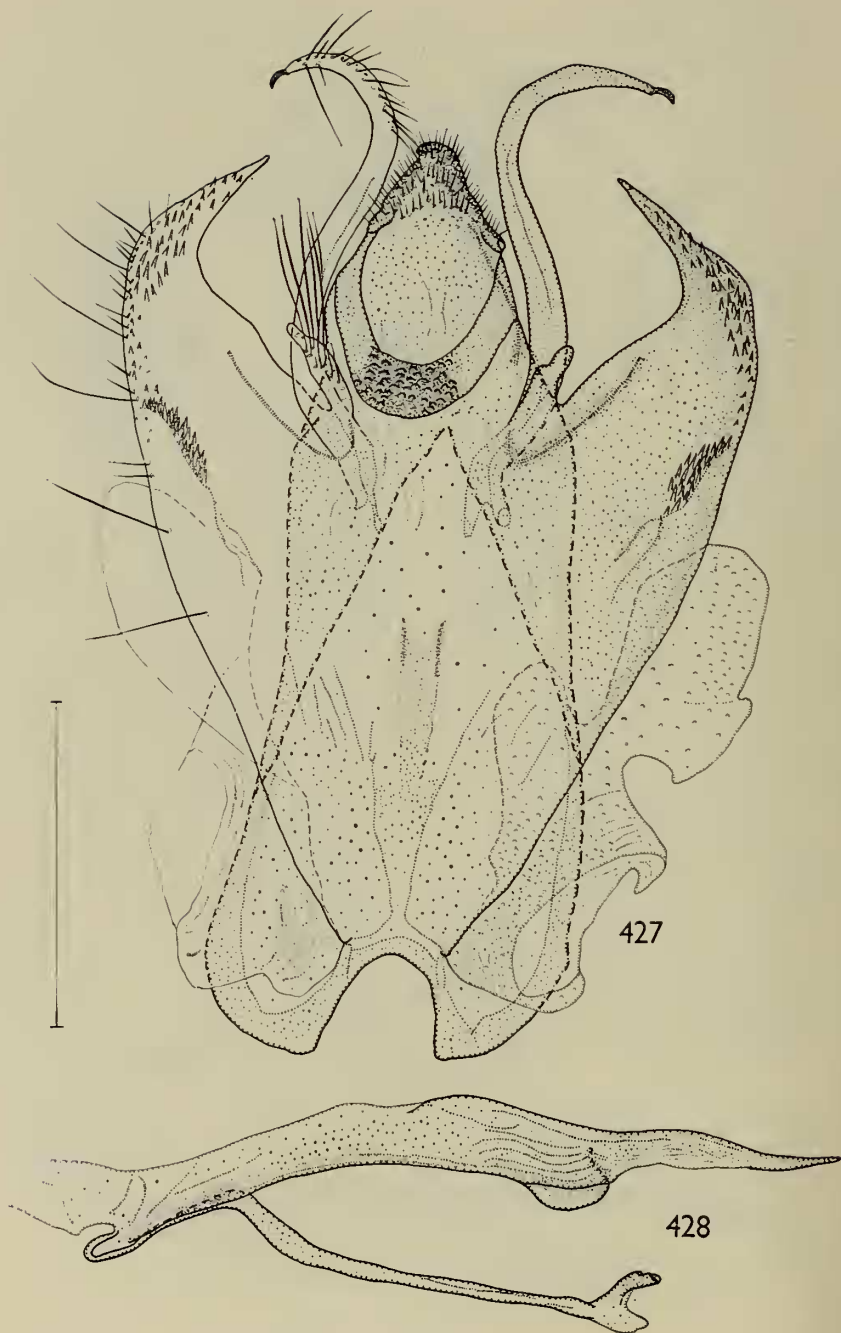


FIGS 423, 424. *Zamarada emaciata*, genitalia (K.S.). 423, ♂; 424, aedeagus.

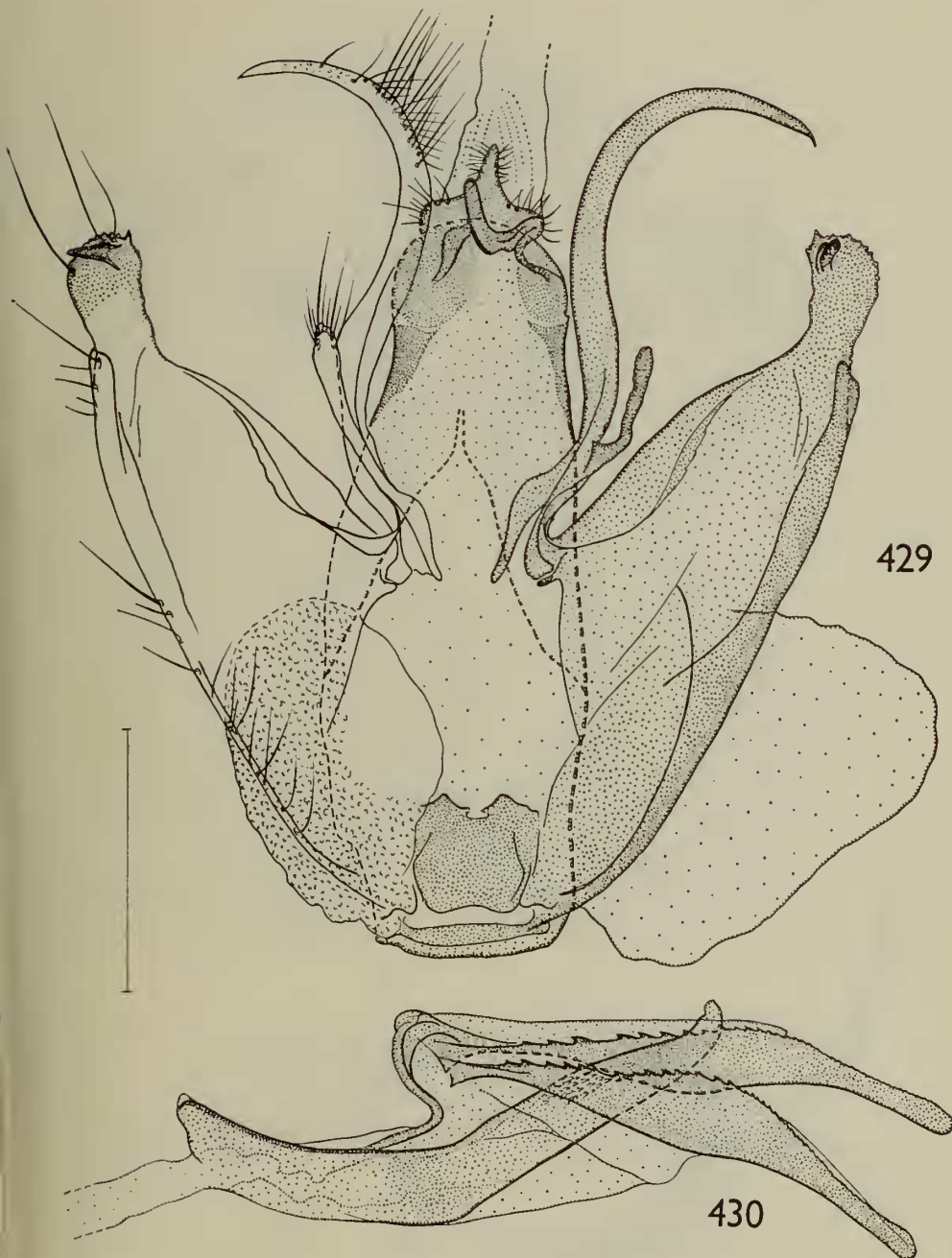


FIGS 425, 426. *Zamarada tullia*, genitalia (K.S.). 425, ♂; 426, aedeagus.

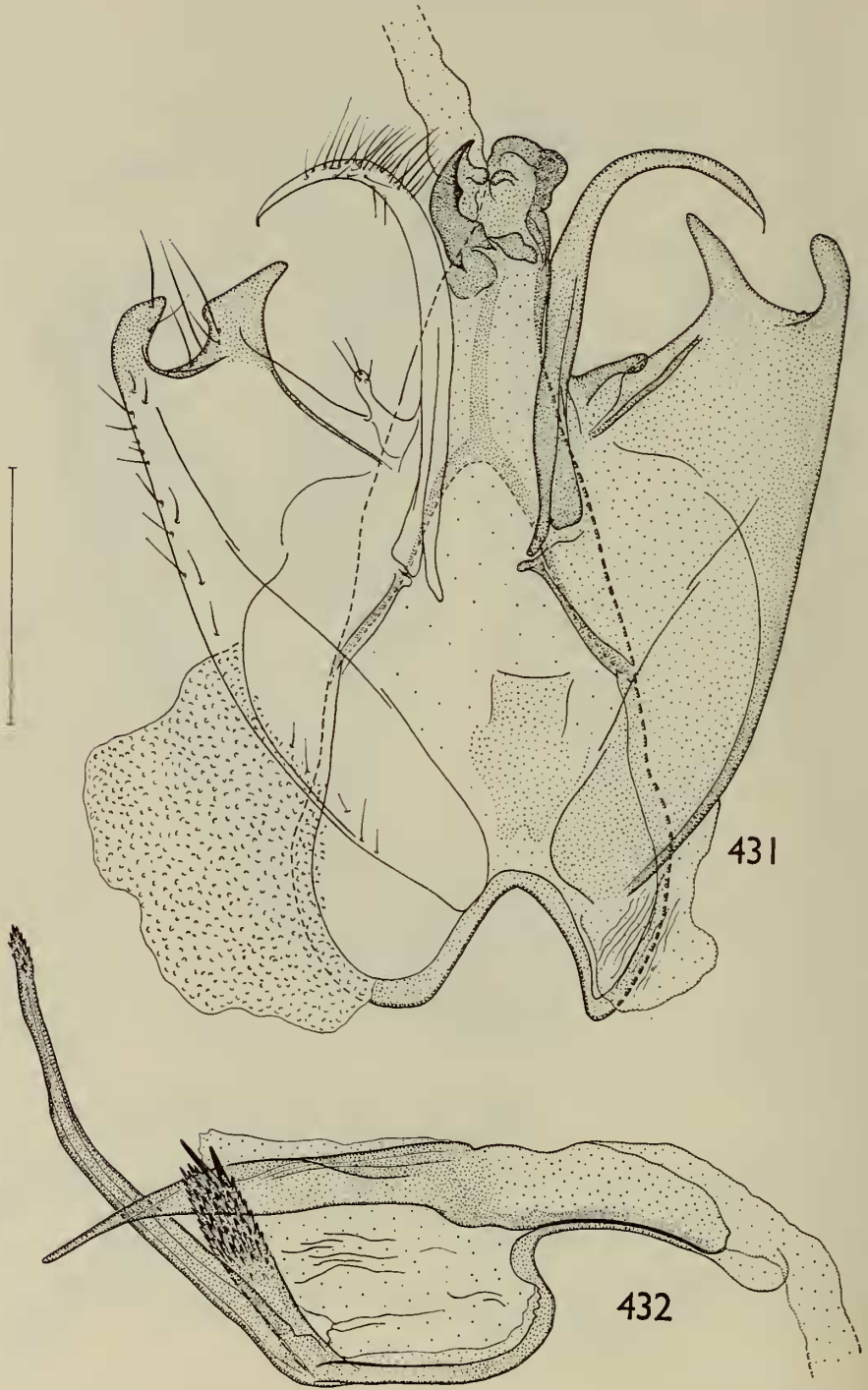




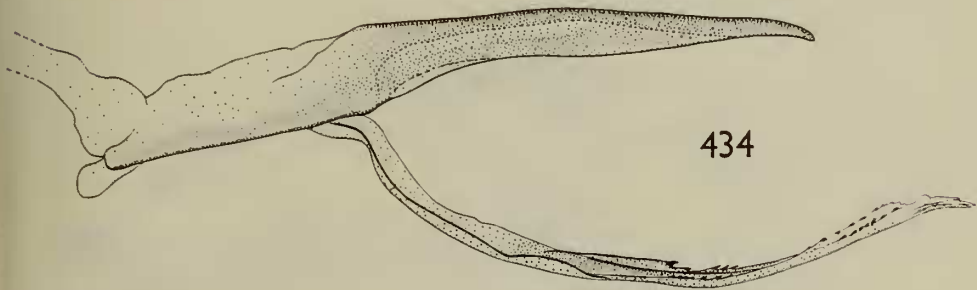
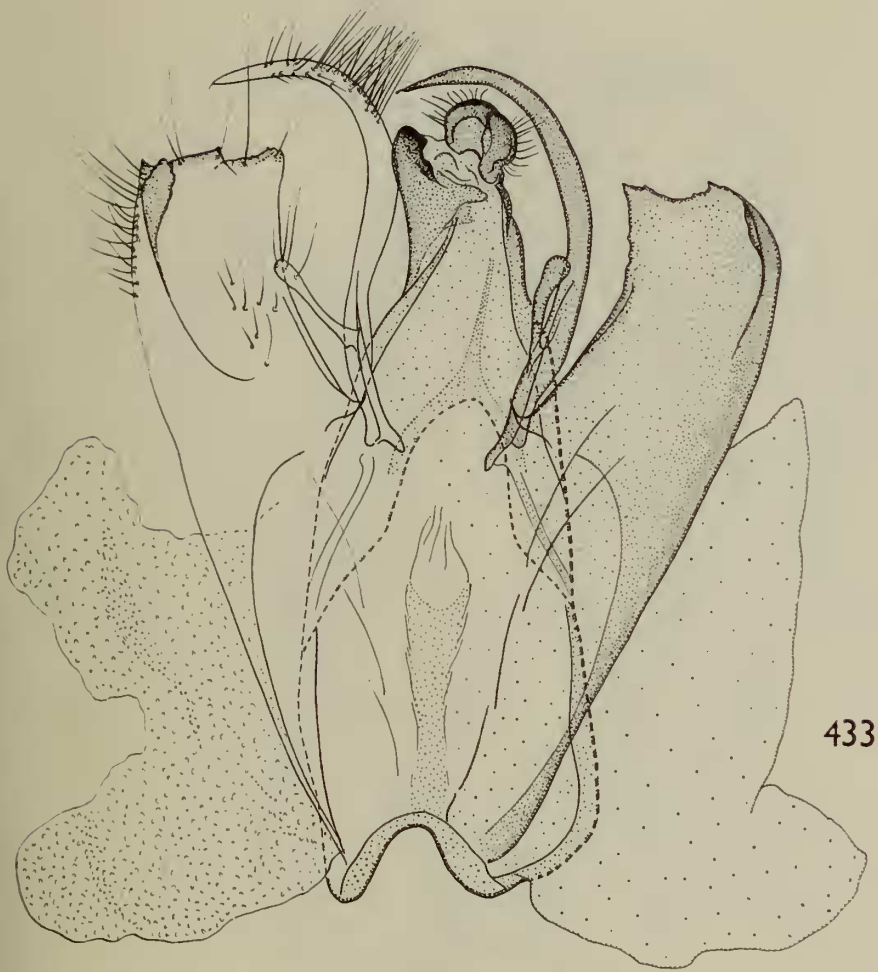
FIGS 427, 428. *Zamarada sagitta*, genitalia (K.S.). 427, ♂; 428, aedeagus.



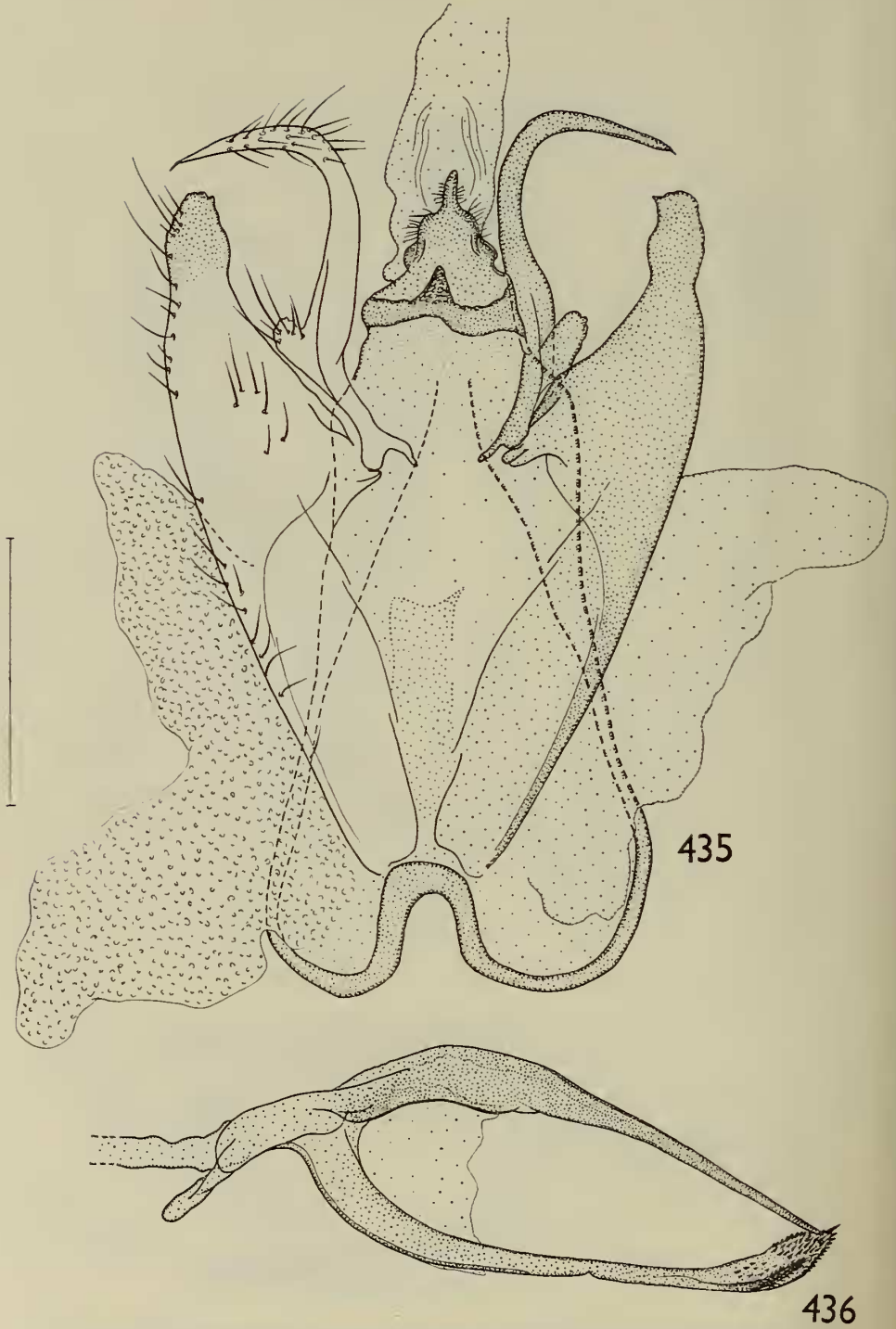
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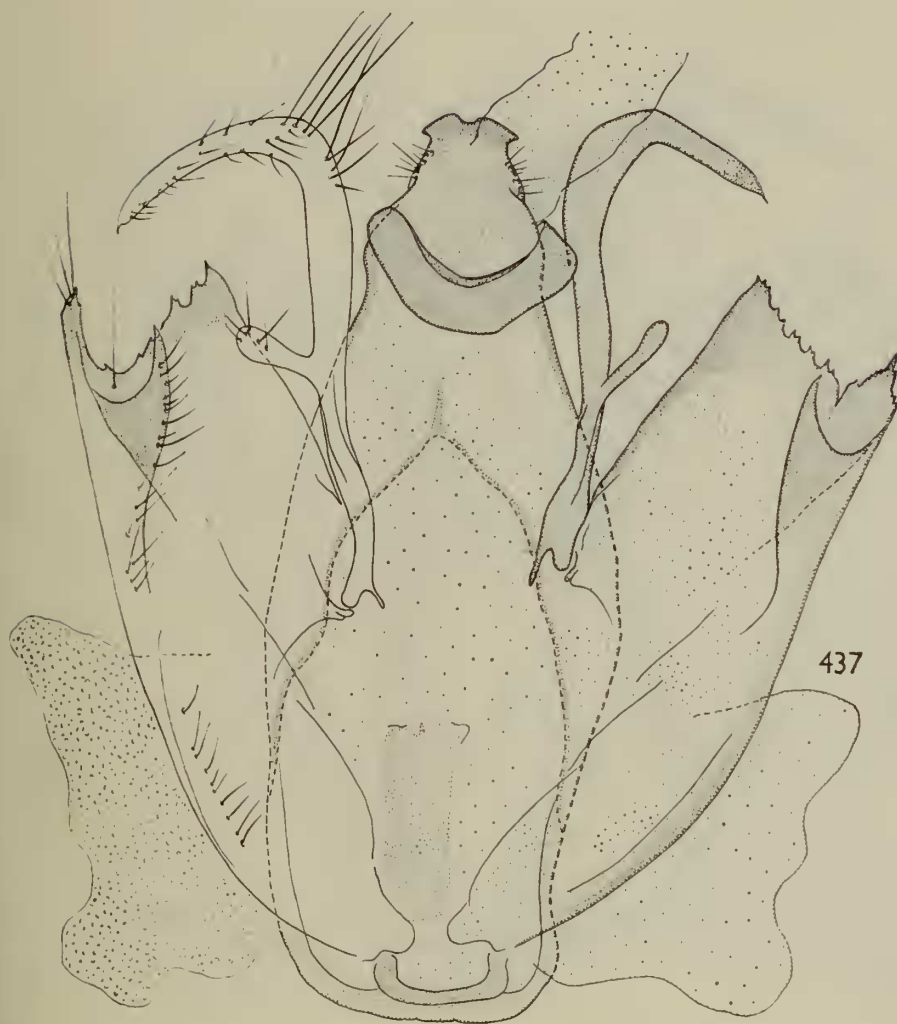


FIGS 433, 434. *Zamarada pelobasis*, genitalia (M.L.). 433, ♂; 434, aedeagus.

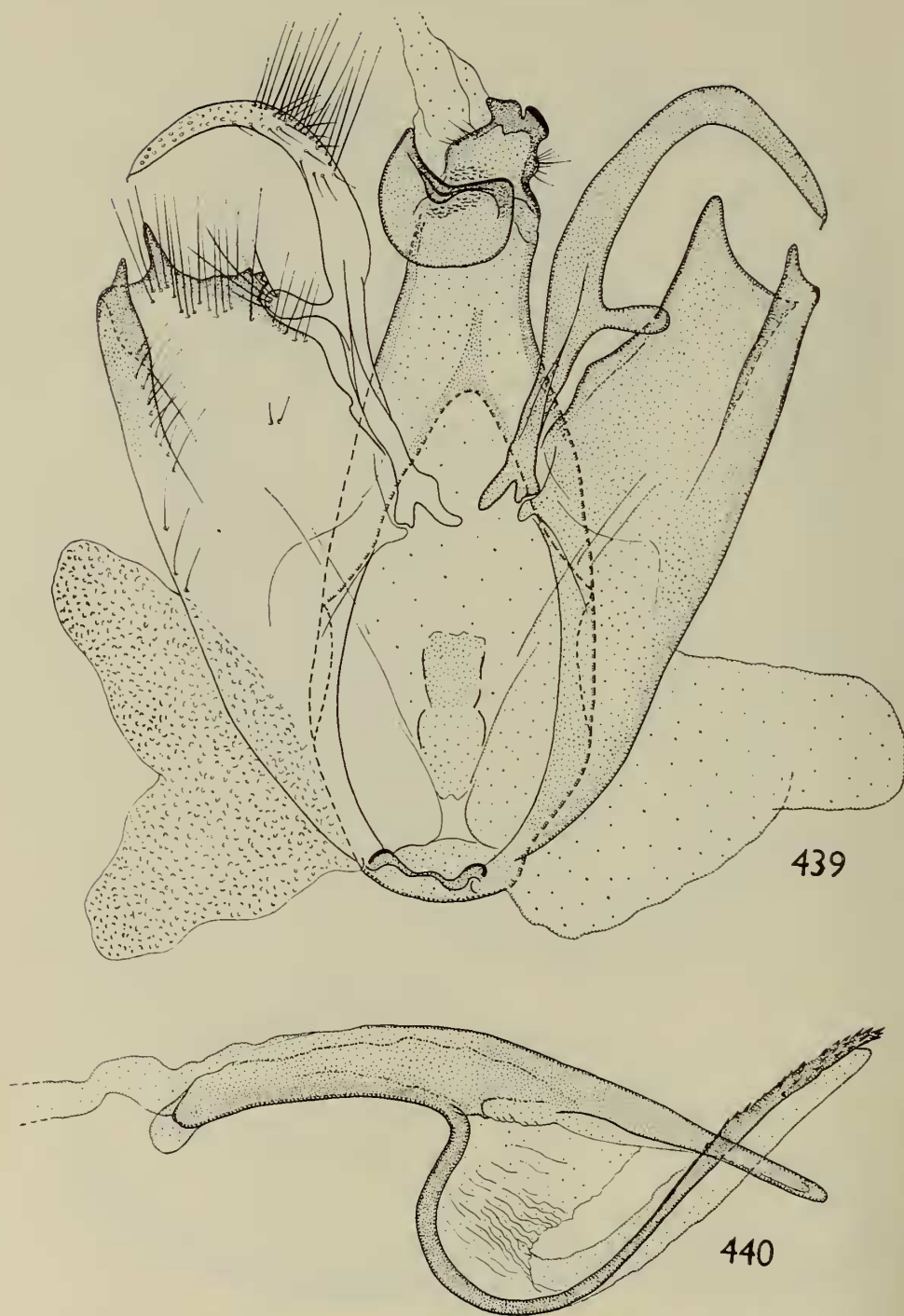


FIGS 435, 436. *Zamarada cator*, genitalia (M.L.). 435, ♂; 436, aedeagus.

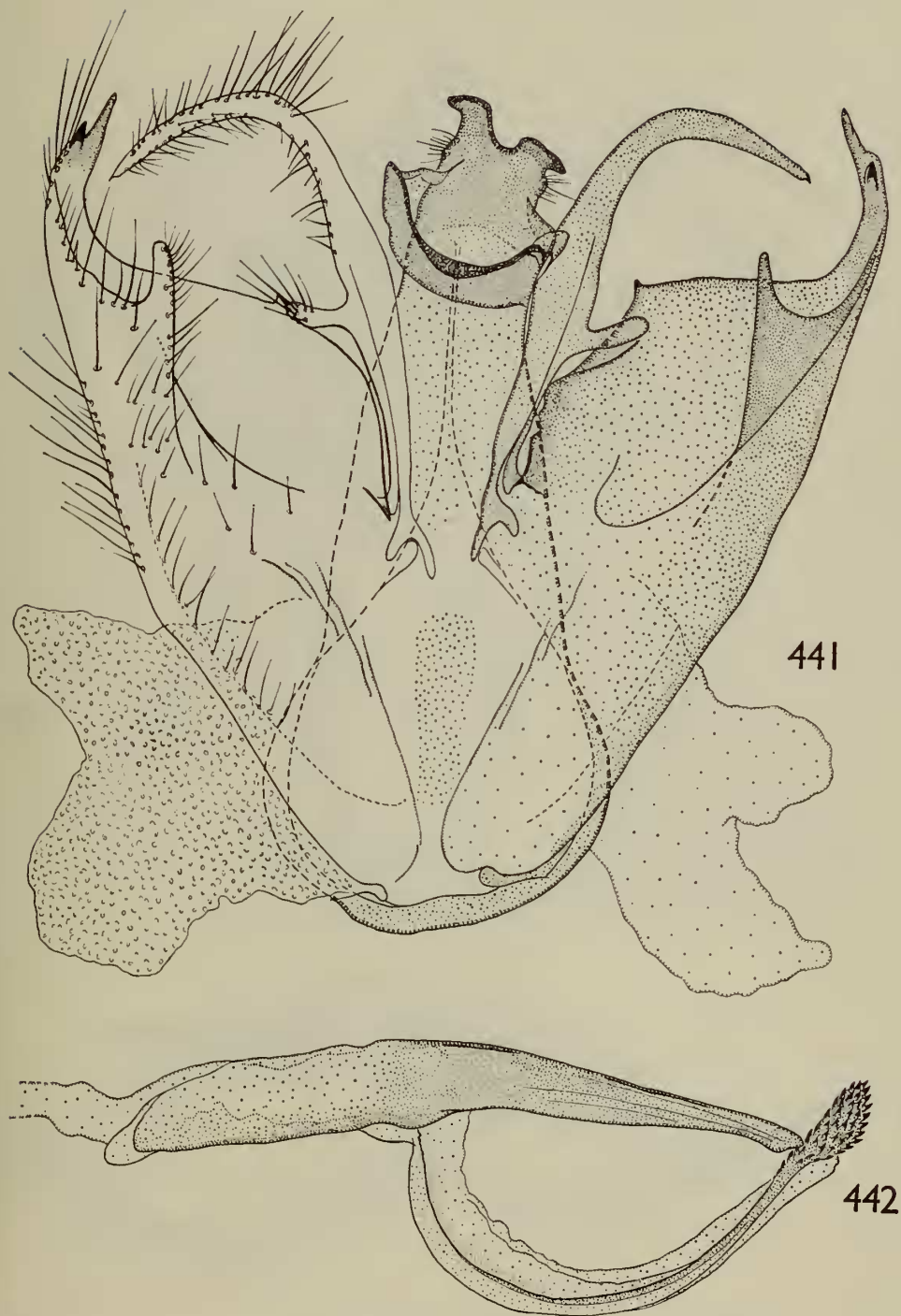




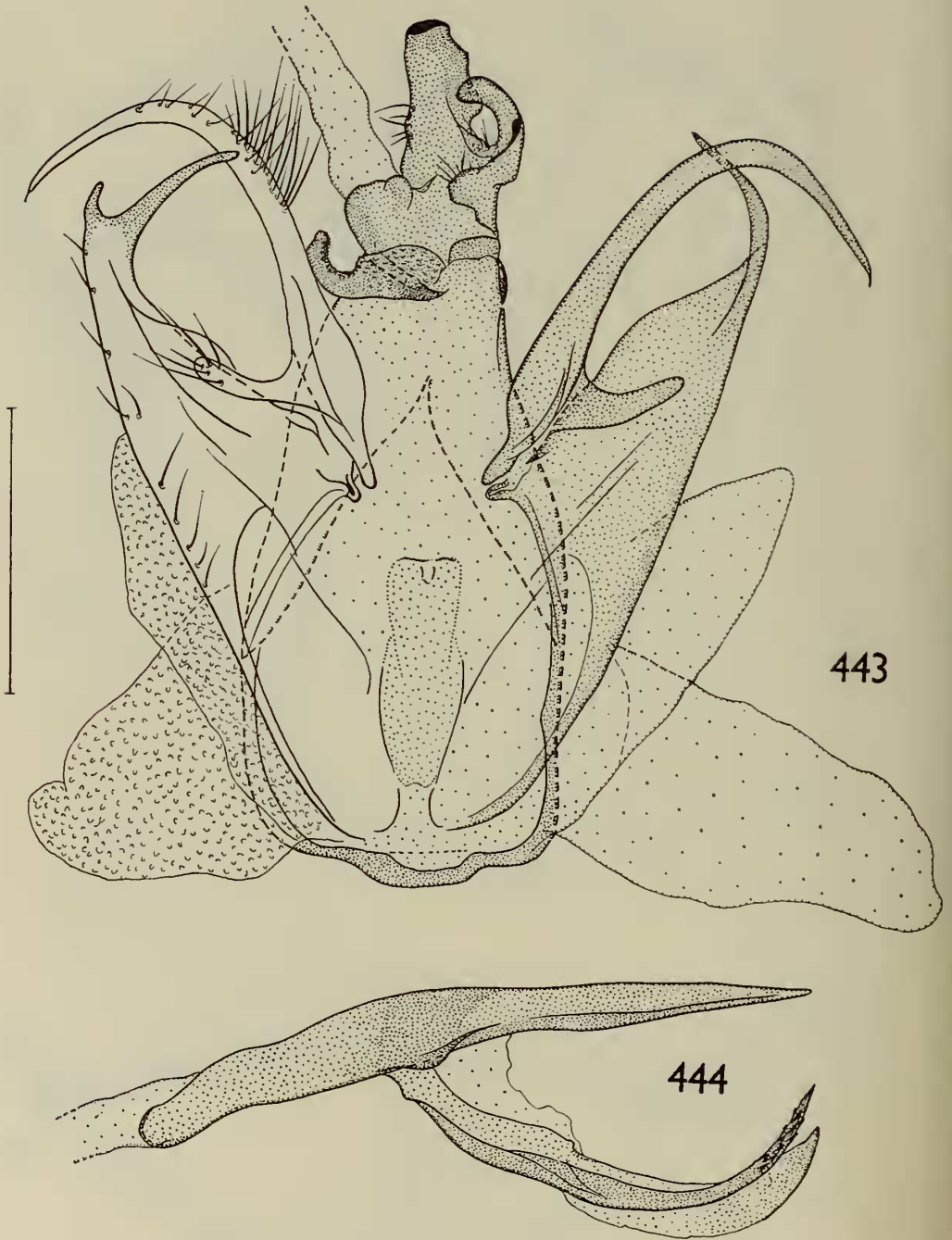
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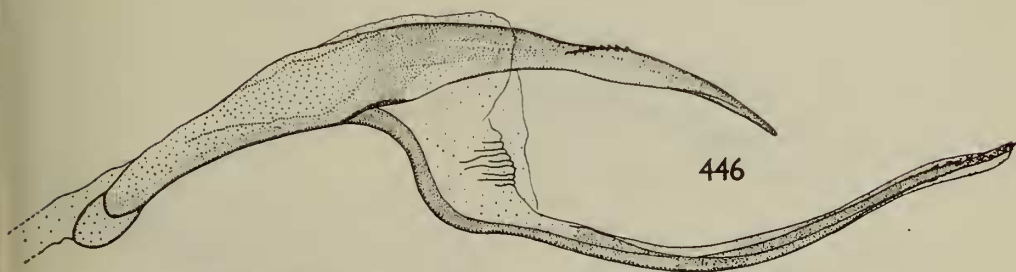
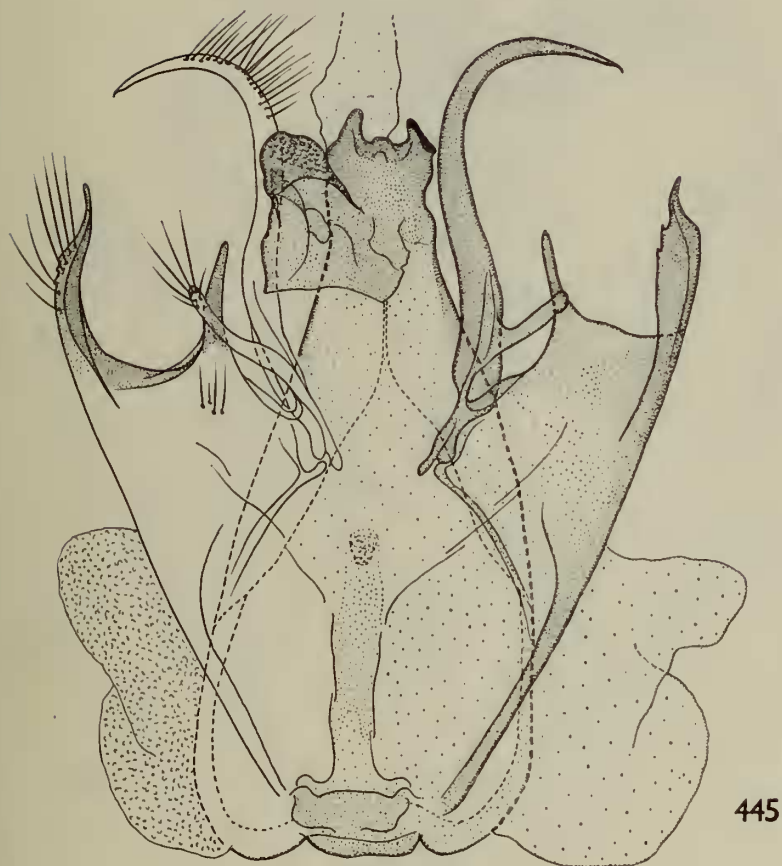
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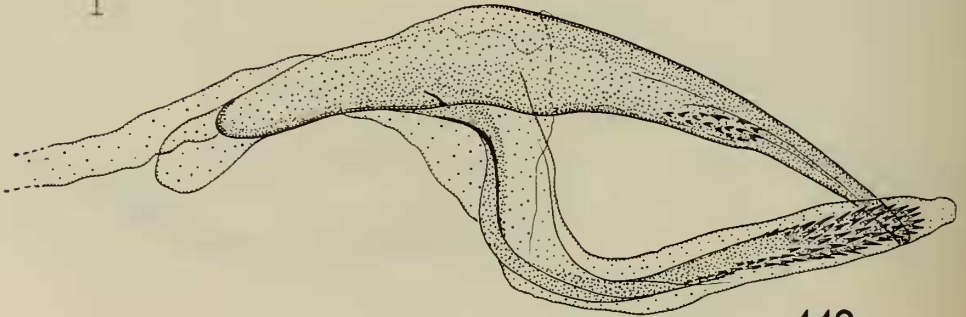
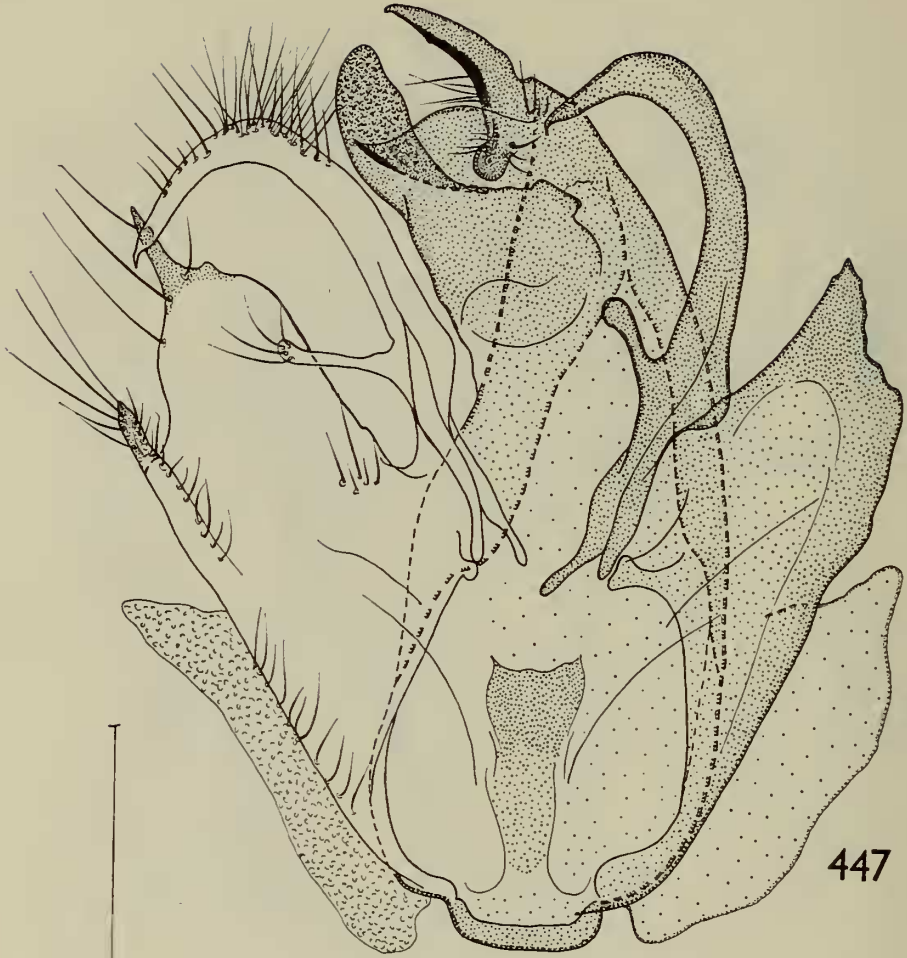


FIGS 443, 444. *Zamarada deformata*, genitalia (M.L.). 443, ♂; 444, aedeagus.



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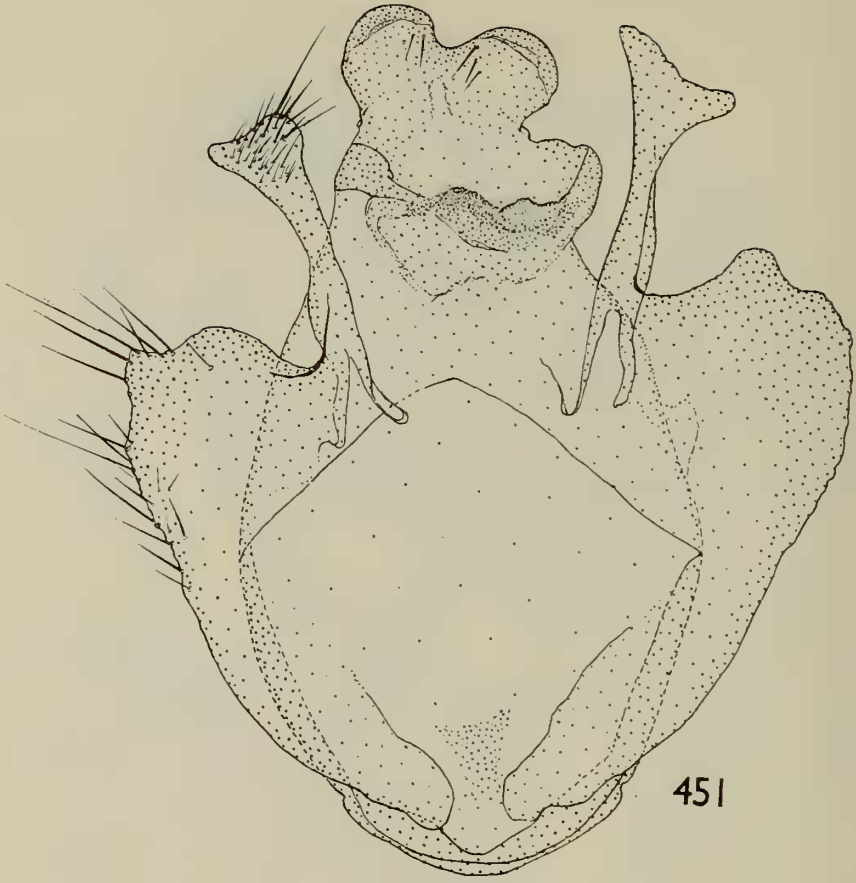




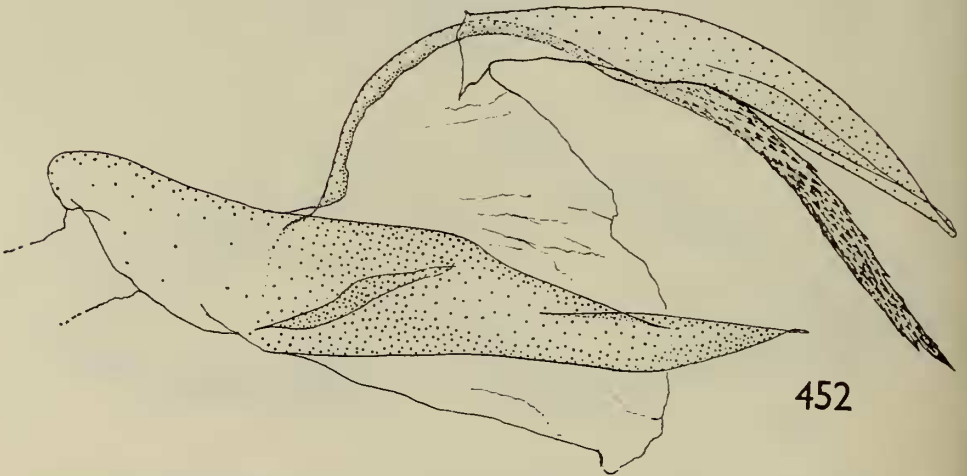
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PLATE I

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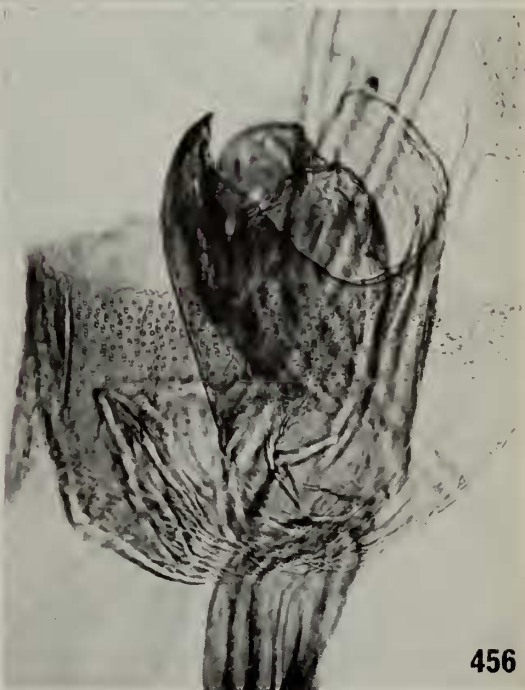
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PLATE 2

- FIG. 457. *Zamarada inermis*, ♀ genitalia.  
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PLATE 3

- FIG. 461. *Zamarada minimaria*, ♀ genitalia.  
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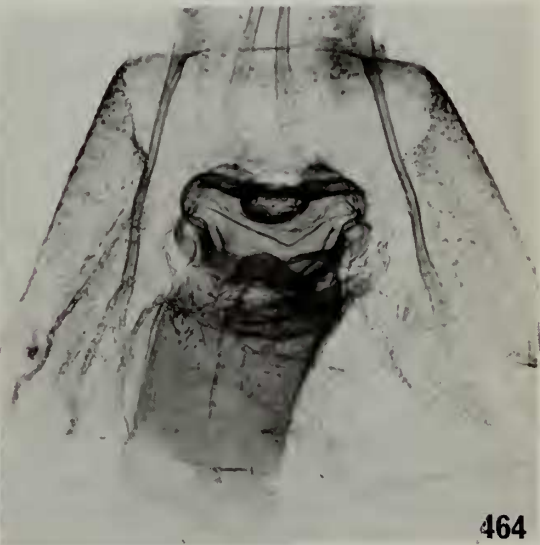
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PLATE 4

- FIG. 465. *Zamarada townsendi*, ♀ genitalia.  
FIG. 466. *Z. townsendi*, sterigma.  
FIG. 467. *Z. anacantha*, ♀ genitalia.  
FIG. 468. *Z. anacantha*, sterigma.



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PLATE 5

- FIG. 469. *Zamarada aureomarginata*, ♀ genitalia.  
FIG. 470. *Z. aureomarginata*, sterigma.  
FIG. 471. *Z. griveaudi*, ♀ genitalia.  
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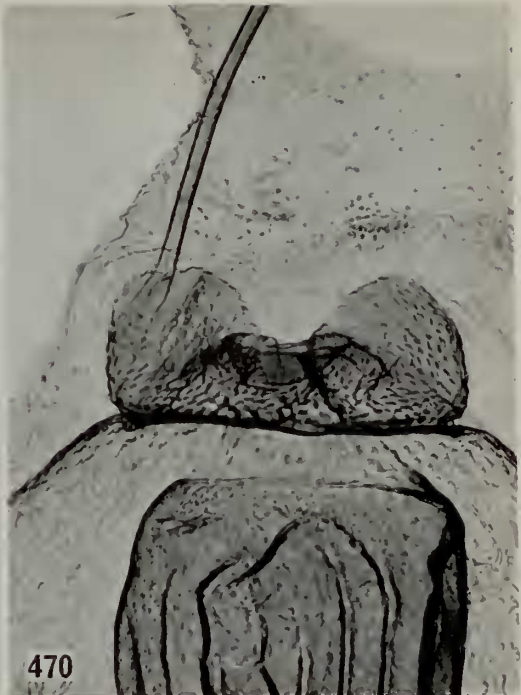


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- FIG. 473. *Zamarada phaeozona*, ♀ genitalia.  
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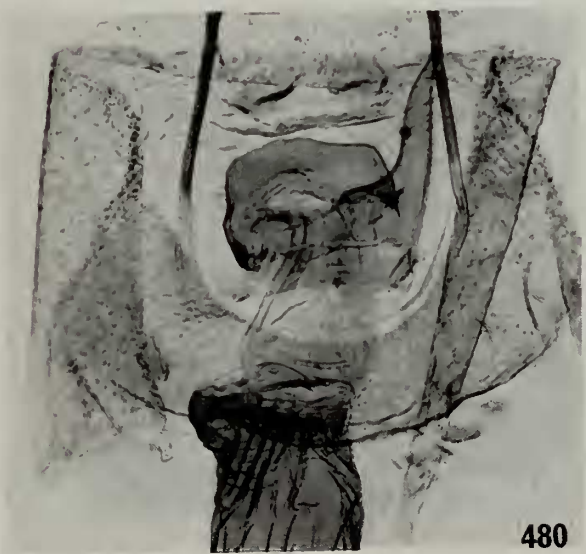
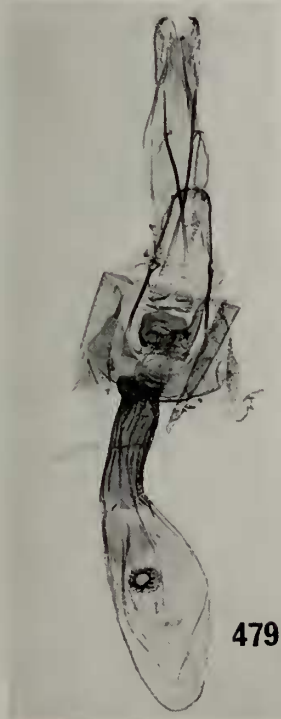
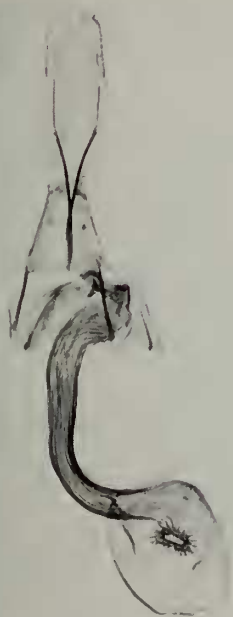


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- FIG. 481. *Zamarada deceptrix*, ♀ genitalia.  
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PLATE 9

- FIG. 485. *Zamarada amicta*, ♀ genitalia.  
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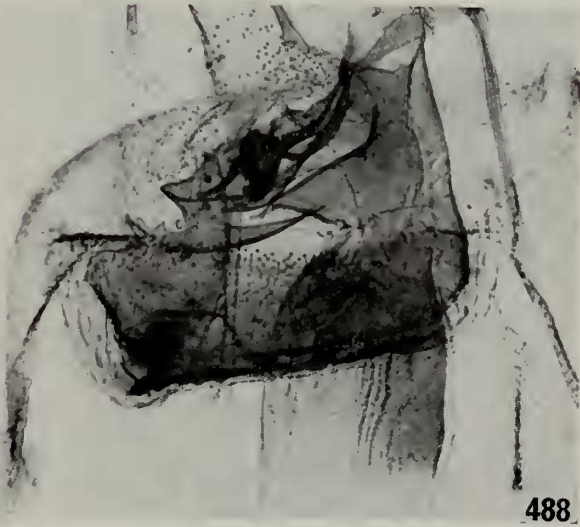
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PLATE 10

- FIG. 489. *Zamarada metallicata*, ♀ genitalia.  
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PLATE 11

- FIG. 493. *Zamarada prionotos*, ♀ genitalia.  
FIG. 494. *Z. prionotos*, sterigma.  
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FIG. 496. *Z. erugata*, sterigma.



PLATE 12

- FIG. 497. *Zamarada pulverosa*, ♀ genitalia.  
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FIG. 499. *Z. pulverosa*, ♀ genitalia.  
FIG. 500. *Z. pulverosa*, sterigma.





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PLATE 13

- FIG. 501. *Zamarada ascapthes*, ♀ genitalia.  
FIG. 502. *Z. ascapthes*, sterigma.  
FIG. 503. *Z. delta*, ♀ genitalia.  
FIG. 504. *Z. delta*, sterigma.

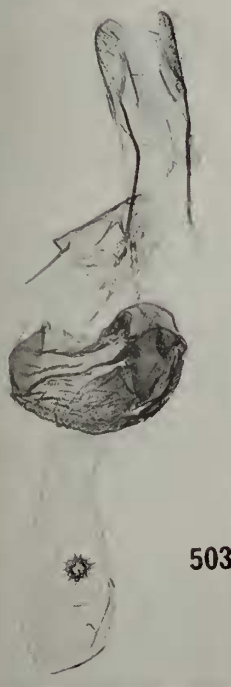


PLATE 14

- FIG. 505. *Zamarada torrida*, ♀ genitalia.  
FIG. 506. *Z. torrida*, sterigma.  
FIG. 507. *Z. tosta*, ♀ genitalia.  
FIG. 508. *Z. tosta*, sterigma.





PLATE 15

- FIG. 509. *Zamarada hyalinaria*, ♀ genitalia.  
FIG. 510. *Z. hyalinaria*, sterigma.  
FIG. 511. *Z. psammites*, ♀ genitalia.  
FIG. 512. *Z. psammites*, sterigma.

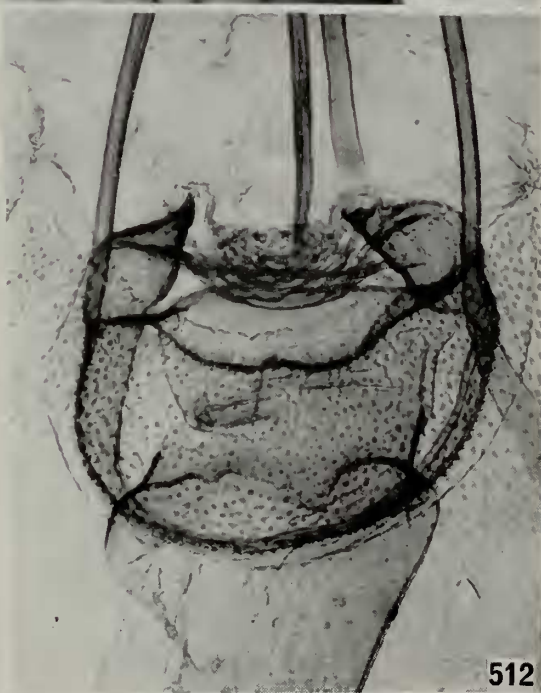


PLATE 16

- FIG. 513. *Zamarada ochrata*, ♀ genitalia.  
FIG. 514. *Z. ochrata*, sterigma.  
FIG. 515. *Z. melasma*, ♀ genitalia.  
FIG. 516. *Z. melasma*, sterigma.



PLATE 17

- FIG. 517. *Zamarada ilma*, ♀ genitalia.  
FIG. 518. *Z. ilma*, sterigma.  
FIG. 519. *Z. differens*, ♀ genitalia.  
FIG. 520. *Z. differens*, sterigma.



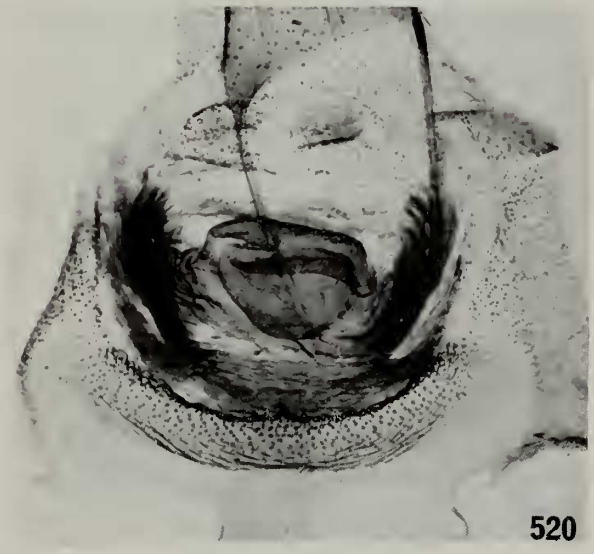


PLATE 18

- FIG. 521. *Zamarada jansei*, ♀ genitalia.  
FIG. 522. *Z. jansei*, sterigma.  
FIG. 523. *Z. scriptifasciata*, ♀ genitalia.  
FIG. 524. *Z. scriptifasciata*, sterigma.

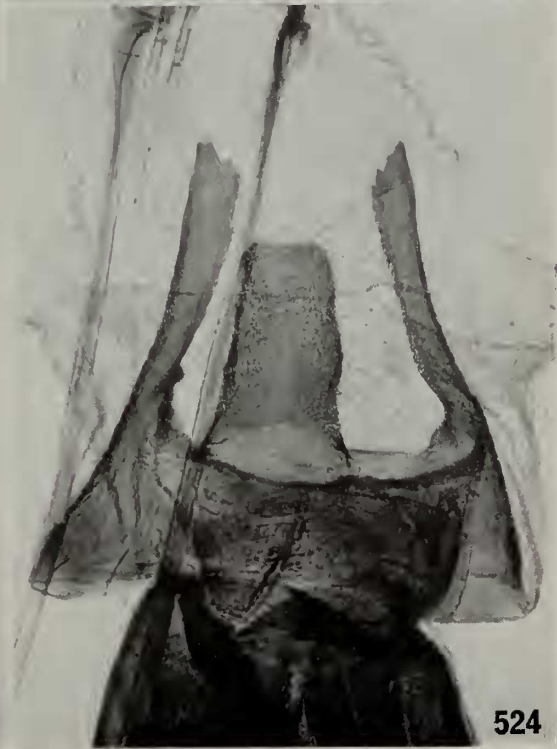


PLATE 19

- FIG. 525. *Zamarada baliata*, ♀ genitalia.  
FIG. 526. *Z. baliata*, sterigma.  
FIG. 527. *Z. fugax*, ♀ genitalia.  
FIG. 528. *Z. fugax*, sterigma.



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PLATE 20

- FIG. 529. *Zamarada symmetra*, ♀ genitalia.  
FIG. 530. *Z. symmetra*, sterigma.  
FIG. 531. *Z. excisa*, ♀ genitalia.  
FIG. 532. *Z. excisa*, sterigma.



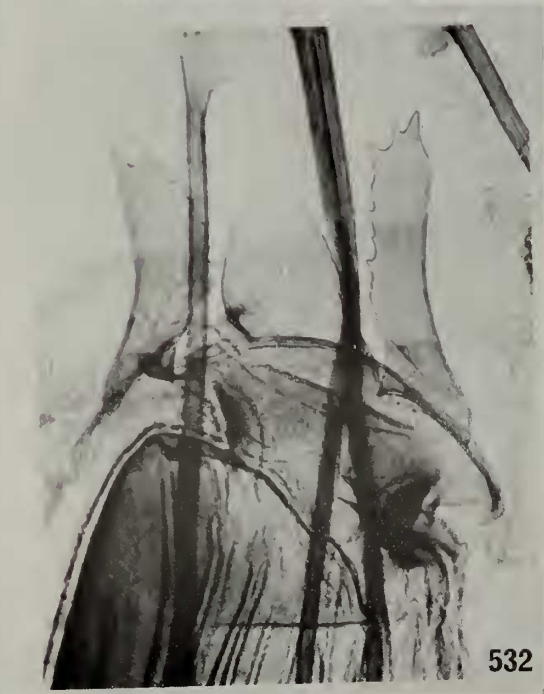
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PLATE 21

- FIG. 533. *Zamarada eogenaria*, ♀ genitalia.  
FIG. 534. *Z. eogenaria*, sterigma.  
FIG. 535. *Z. nesiotica*, ♀ genitalia.  
FIG. 536. *Z. nesiotica*, sterigma.

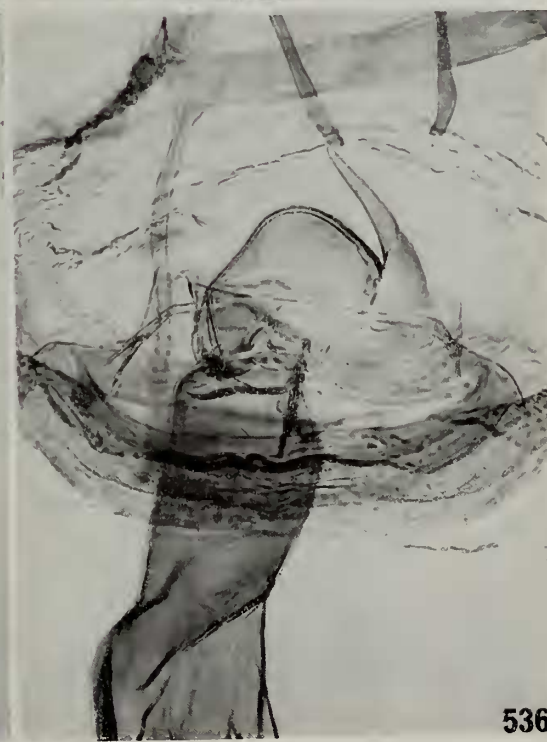
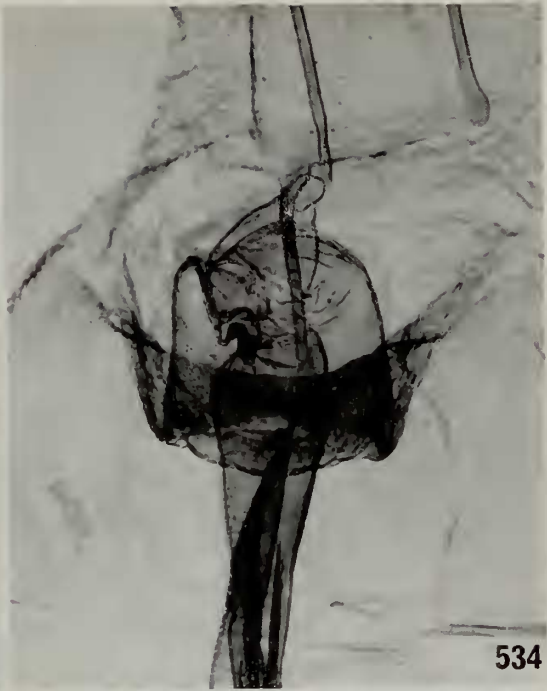


PLATE 22

- FIG. 537. *Zamarada ucata*, ♀ genitalia.  
FIG. 538. *Z. ucata*, sterigma.  
FIG. 539. *Z. schalida*, ♀ genitalia.  
FIG. 540. *Z. schalida*, sterigma.





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PLATE 23

- FIG. 541. *Zamarada flavicosta*, ♀ genitalia.  
FIG. 542. *Z. flavicosta*, sterigma.  
FIG. 543. *Z. indicata*, ♀ genitalia.  
FIG. 544. *Z. indicata*, sterigma.

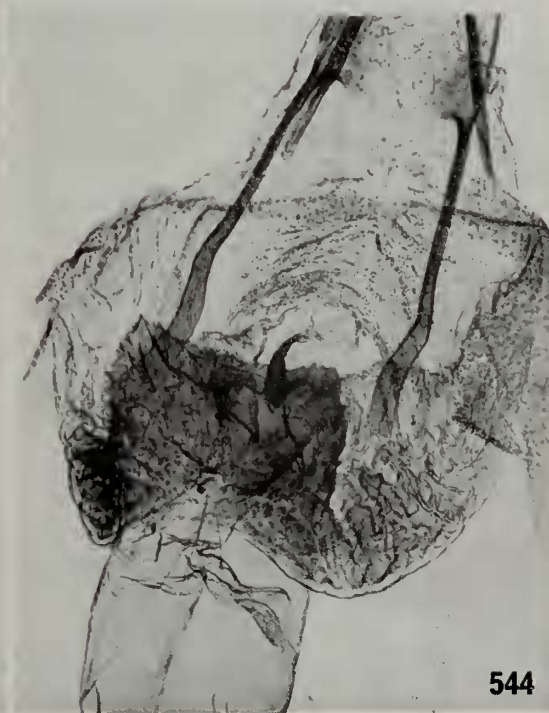


PLATE 24

- FIG. 545. *Zamarada regularis regularis*, ♀ genitalia.  
FIG. 546. *Z. regularis regularis*, sterigma.  
FIG. 547. *Z. regularis arcuata*, ♀ genitalia.  
FIG. 548. *Z. regularis arcuata*, sterigma.



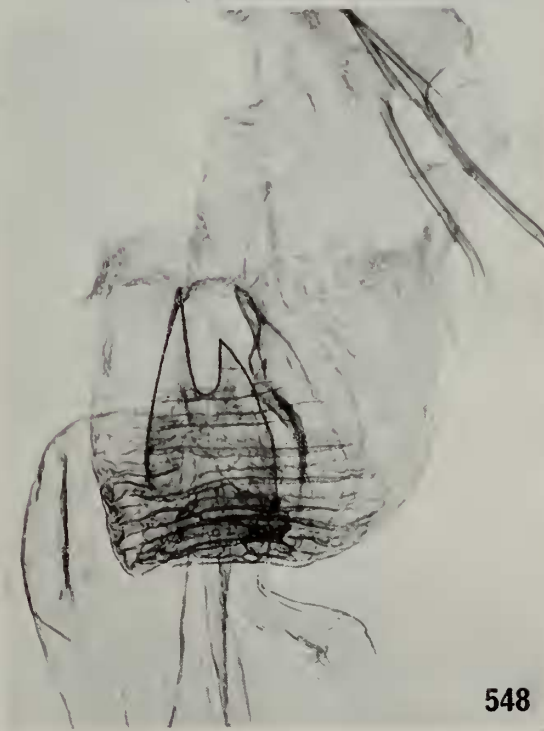
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PLATE 25

- FIG. 549. *Zamarada pringlei*, ♀ genitalia.  
FIG. 550. *Z. pringlei*, sterigma.  
FIG. 551. *Z. psectra*, ♀ genitalia.  
FIG. 552. *Z. psectra*, sterigma.



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PLATE 26

- FIG. 553. *Zamarada excavata excavata*, ♀ genitalia.  
FIG. 554. *Z. excavata excavata*, sterigma.  
FIG. 555. *Z. excavata acis*, ♀ genitalia.  
FIG. 556. *Z. excavata acis*, sterigma.



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PLATE 27

- FIG. 557. *Zamarada episema*, ♀ genitalia.  
FIG. 558. *Z. episema*, sterigma.  
FIG. 559. *Z. laciniata*, ♀ genitalia.  
FIG. 560. *Z. laciniata*, sterigma.





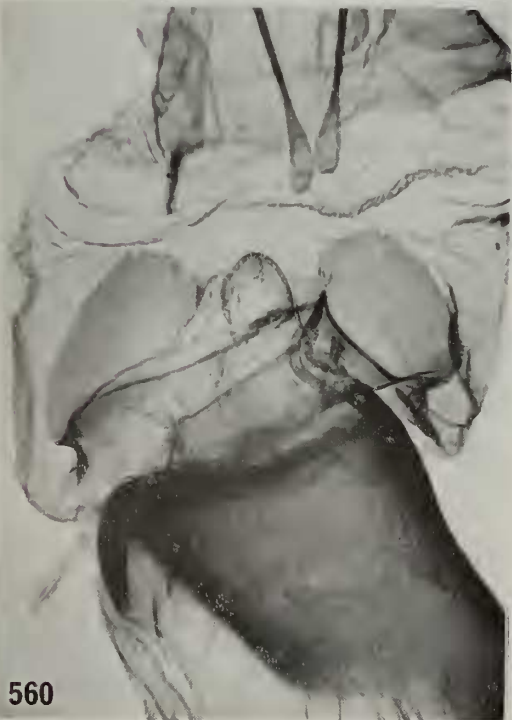
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PLATE 28

- FIG. 561. *Zamarada dyscapna*, ♀ genitalia.  
FIG. 562. *Z. dyscapna*, sterigma.  
FIG. 563. *Z. radula*, ♀ genitalia.  
FIG. 564. *Z. radula*, sterigma.



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PLATE 29

- FIG. 565. *Zamarada cinereata*, ♀ genitalia.  
FIG. 566. *Z. cinereata*, sterigma.  
FIG. 567. *Z. sicula*, ♀ genitalia.  
FIG. 568. *Z. sicula*, sterigma.



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PLATE 30

- FIG. 56c. *Zamarada manifesta*, ♀ genitalia.  
FIG. 570. *Z. manifesta*, sterigma.  
FIG. 571. *Z. corymbophora*, ♀ genitalia.  
FIG. 572. *Z. corymbophora*, sterigma.

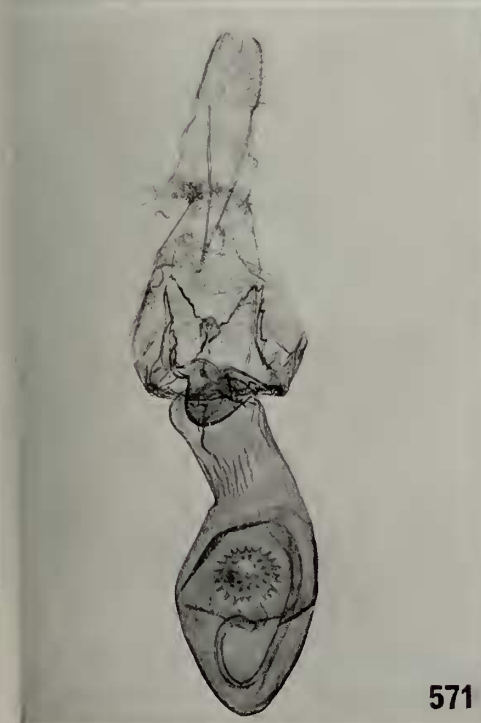
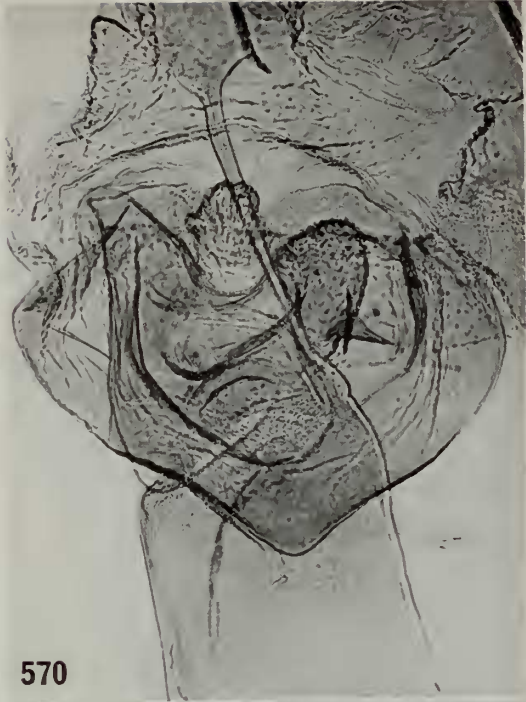
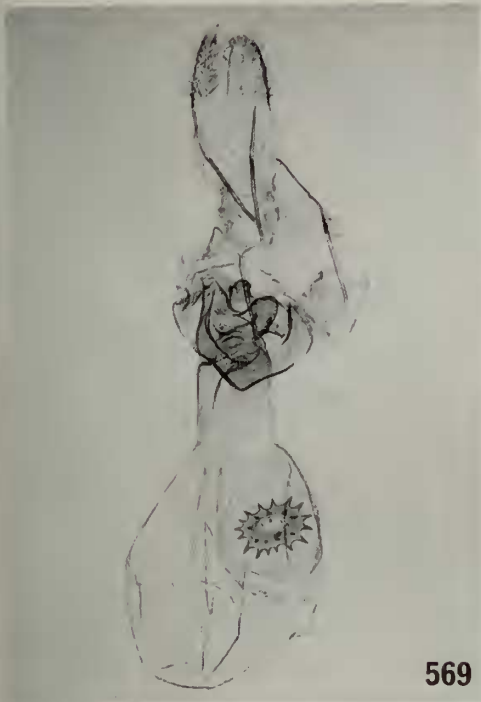


PLATE 31

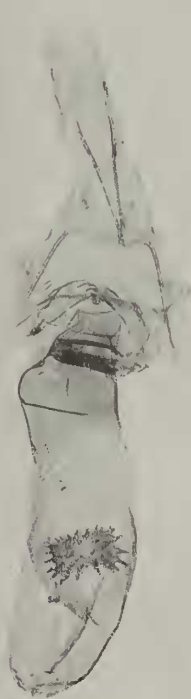
- FIG. 573. *Zamarada hero*, ♀ genitalia.  
FIG. 574. *Z. hero*, sterigma.  
FIG. 575. *Z. melpomene*, ♀ genitalia.  
FIG. 576. *Z. melpomene*, sterigma.



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PLATE 32

- FIG. 577. *Zamarada setosa*, ♀ genitalia.  
FIG. 578. *Z. setosa*, sterigma.  
FIG. 579. *Z. oxybeles*, ♀ genitalia.  
FIG. 580. *Z. oxybeles*, sterigma.





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PLATE 33

- FIG. 581. *Zamarada subinterrupta*, ♀ genitalia.  
FIG. 582. *Z. subinterrupta*, sterigma.  
FIG. 583. *Z. lophobela*, ♀ genitalia.  
FIG. 584. *Z. lophobela*, sterigma.



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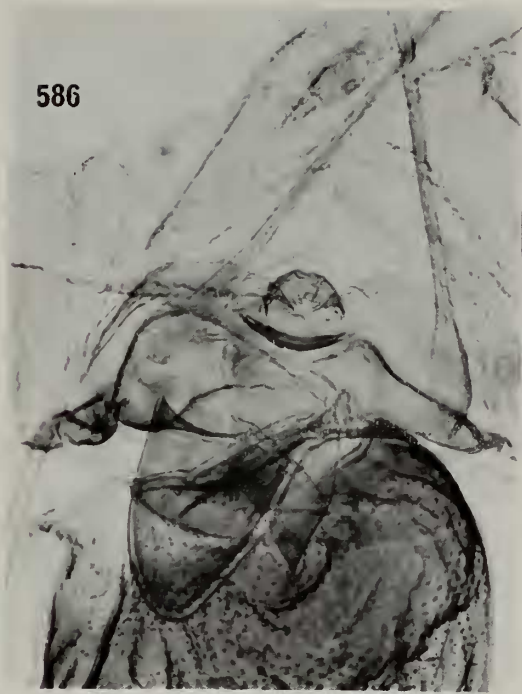
PLATE 34

- FIG. 585. *Zamarada protrusa*, ♀ genitalia.  
FIG. 586. *Z. protrusa*, sterigma.  
FIG. 587. *Z. sinecalcarata*, ♀ genitalia.  
FIG. 588. *Z. sinecalcarata*, sterigma.

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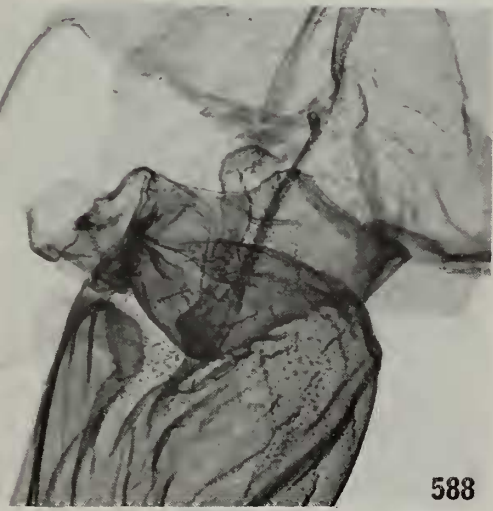




PLATE 35

- FIG. 589. *Zamarada lanceolata*, ♀ genitalia.  
FIG. 590. *Z. lanceolata*, sterigma  
FIG. 591. *Z. carcassoni*, ♀ genitalia.  
FIG. 592. *Z. carcassoni*, sterigma.



PLATE 36

- FIG. 593. *Zamarada bernardii*, ♀ genitalia.  
FIG. 594. *Z. bernardii*, sterigma.  
FIG. 595. *Z. antimima*, ♀ genitalia.  
FIG. 596. *Z. antimima*, sterigma.

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PLATE 37

- FIG. 597. *Zamarada strigilecula*, ♀ genitalia.  
FIG. 598. *Z. strigilecula*, sterigma.  
FIG. 599. *Z. arguta*, ♀ genitalia.  
FIG. 600. *Z. arguta*, sterigma.





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PLATE 38

- FIG. 601. *Zamarada dentigera*, ♀ genitalia.  
FIG. 602. *Z. dentigera*, sterigma.  
FIG. 603. *Z. chrysopa*, ♀ genitalia.  
FIG. 604. *Z. chrysopa*, sterigma.

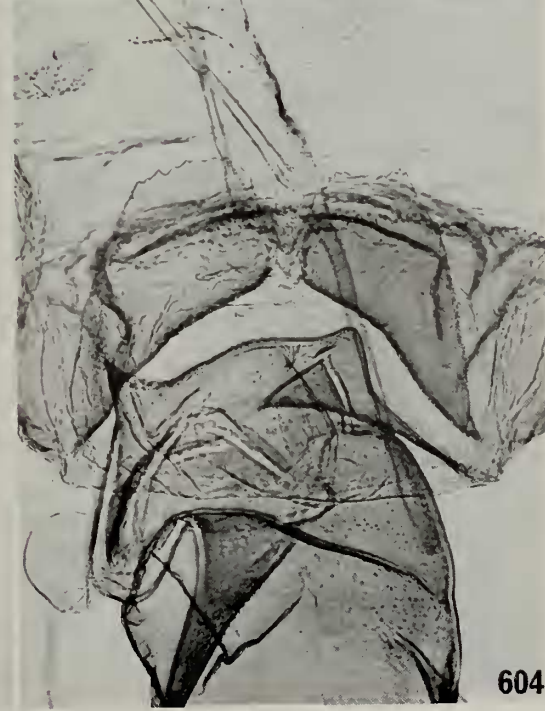
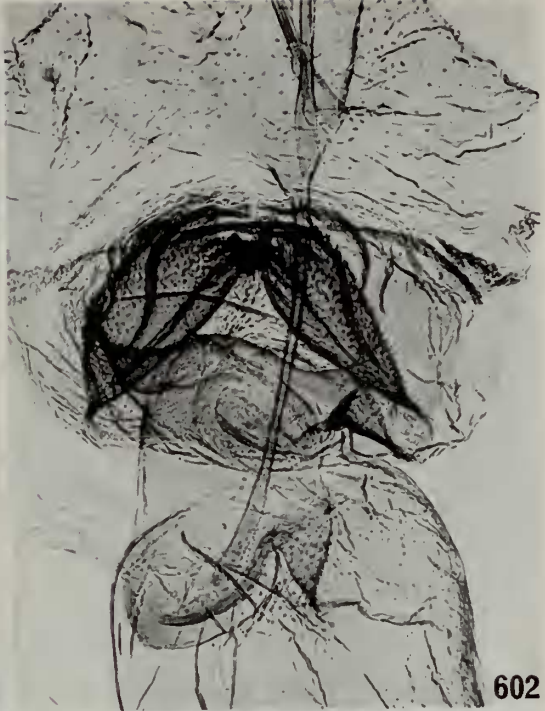


PLATE 39

- FIG. 605. *Zamarada fibulata*, ♀ genitalia.  
FIG. 606. *Z. fibulata*, sterigma.  
FIG. 607. *Z. urania*, ♀ genitalia.  
FIG. 608. *Z. urania*, sterigma.





PLATE 40

- FIG. 609. *Zamarada melanopyga*, ♀ genitalia.  
FIG. 610. *Z. melanopyga*, sterigma.  
FIG. 611. *Z. ostracodes*, ♀ genitalia.  
FIG. 612. *Z. ostracodes*, sterigma.

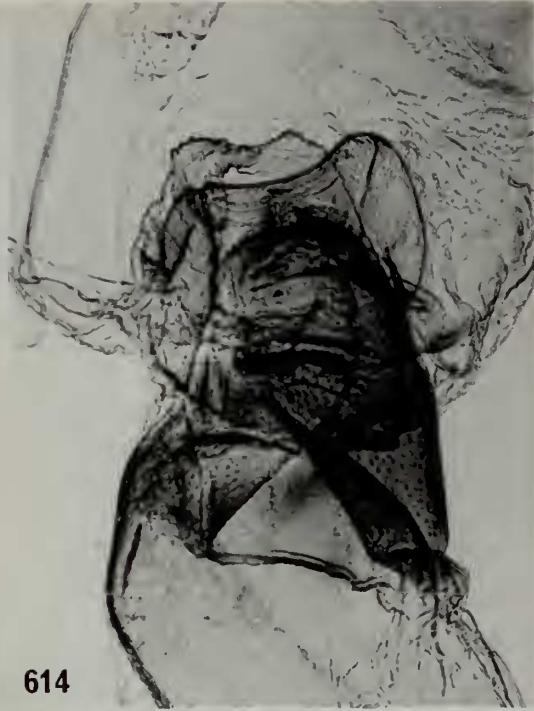


PLATE 41

- FIG. 613. *Zamarada aglae*, ♀ genitalia.  
FIG. 614. *Z. aglae*, sterigma.  
FIG. 615. *Z. ariste*, ♀ genitalia.  
FIG. 616. *Z. ariste*, sterigma.



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PLATE 42

- FIG. 617. *Zamarada phoenopasta*, ♀ genitalia.  
FIG. 618. *Z. phoenopasta*, sterigma.  
FIG. 619. *Z. viettei*, ♀ genitalia.  
FIG. 620. *Z. viettei*, sterigma.





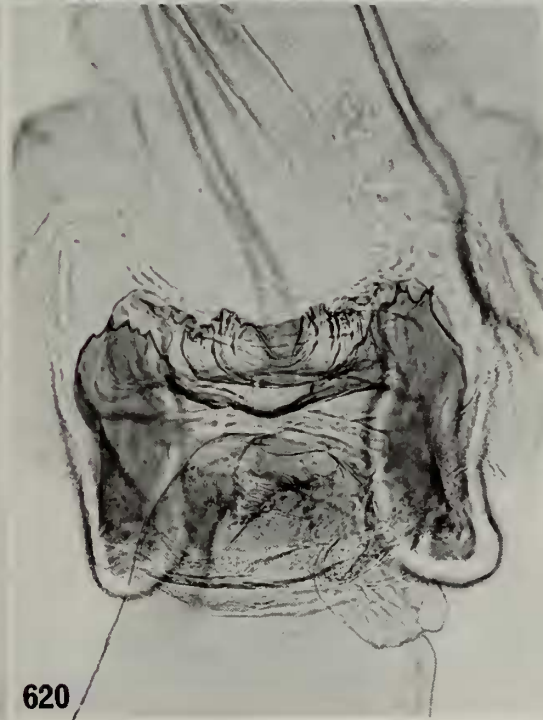
617



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PLATE 43

- FIG. 621. *Zamarada cepa*, ♀ genitalia.  
FIG. 622. *Z. cepa*, sterigma.  
FIG. 623. *Z. xystra*, ♀ genitalia.  
FIG. 624. *Z. xystra*, sterigma.

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PLATE 44

- FIG. 625. *Zamarada ilaria*, ♀ genitalia.  
FIG. 626. *Z. ilaria*, sterigma.  
FIG. 627. *Z. gaedei*, ♀ genitalia.  
FIG. 628. *Z. gaedei*, sterigma.



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PLATE 45

- FIG. 629. *Zamarada transvisaria*, ♀ genitalia.  
FIG. 630. *Z. transvisaria*, sterigma.  
FIG. 631. *Z. calypso*, ♀ genitalia.  
FIG. 632. *Z. calypso*, sterigma.



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PLATE 46

- FIG. 633. *Zamarada iobathra*, ♀ genitalia.  
FIG. 634. *Z. iobathra*, sterigma.  
FIG. 635. *Z. euryscaphes*, ♀ genitalia.  
FIG. 636. *Z. euryscaphes*, sterigma.



PLATE 47

- FIG. 637. *Zamarada odontophora*, ♀ genitalia.  
FIG. 638. *Z. odontophora*, sterigma.  
FIG. 639. *Z. bathyscaphes*, ♀ genitalia.  
FIG. 640. *Z. adiposata*, ♀ genitalia.  
FIG. 641. *Z. aequilumata*, ♀ genitalia.





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PLATE 48

- FIG. 642. *Zamarada bathyscaphes*, sterigma.  
FIG. 643. *Z. bathyscaphes*, sterigma.  
FIG. 644. *Z. adiposata*, sterigma.  
FIG. 645. *Z. adiposata*, sterigma.

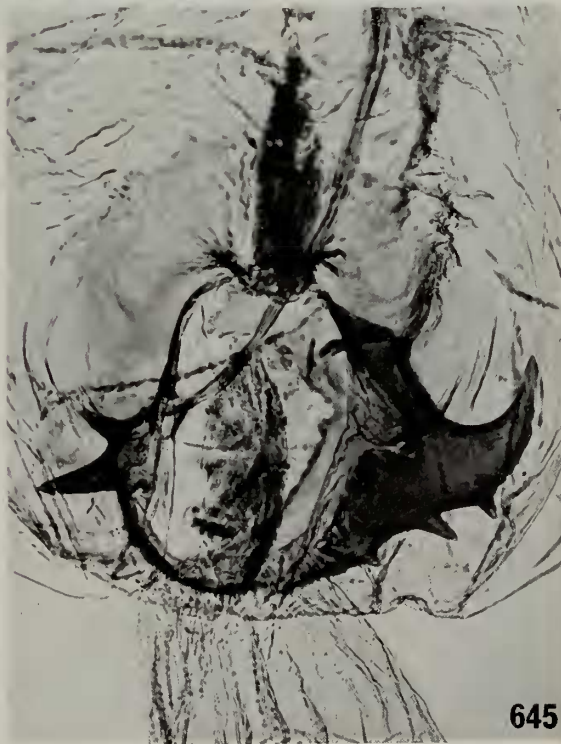
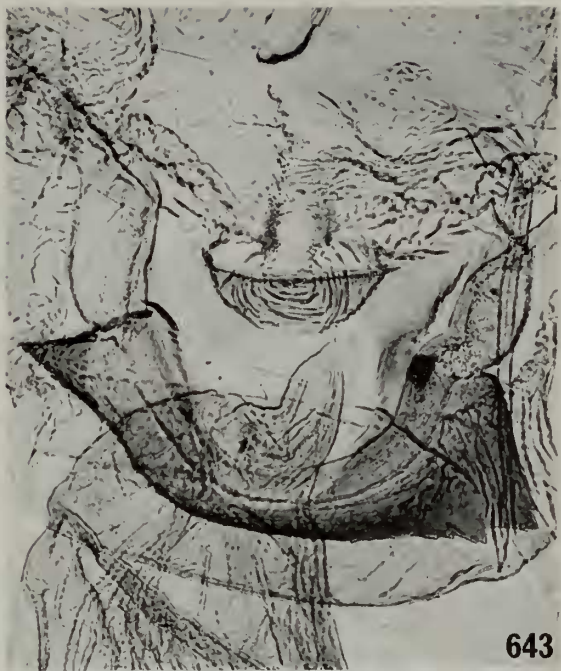
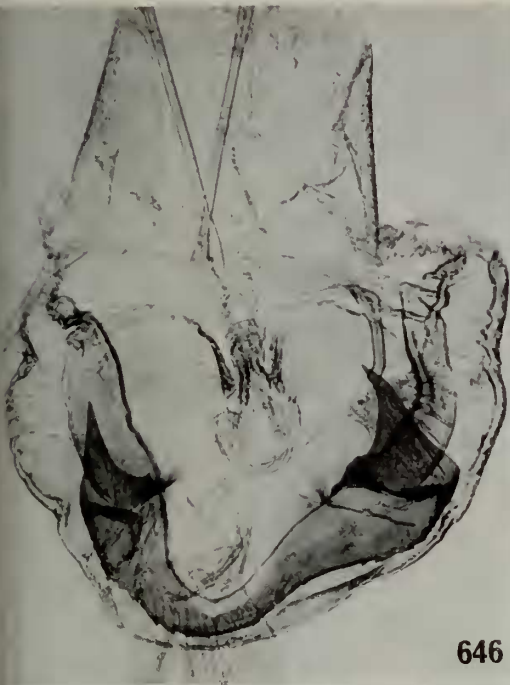


PLATE 49

- FIG. 646. *Zamarada aequilumata*, sterigma.  
FIG. 647. *Z. aequilumata*, sterigma.  
FIG. 648. *Z. aclea*, ♀ genitalia.  
FIG. 649. *Z. aclea*, sterigma.



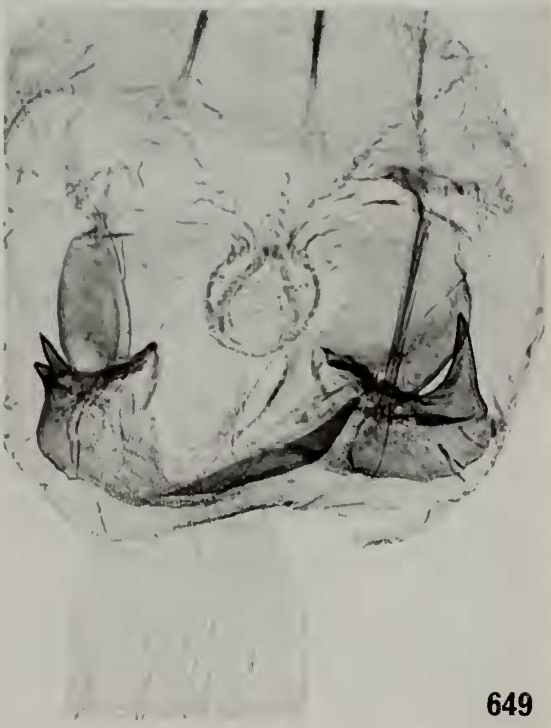
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PLATE 50

- FIG. 650. *Zamarada psi*, ♀ genitalia.  
FIG. 651. *Z. psi*, sterigma.  
FIG. 652. *Z. purimargo*, ♀ genitalia.  
FIG. 653. *Z. purimargo*, sterigma.



PLATE 51

- FIG. 654. *Zamarada leptä*, ♀ genitalia.  
FIG. 655. *Z. leptä*, sterigma.  
FIG. 656. *Z. suda*, ♀ genitalia.  
FIG. 657. *Z. suda*, sterigma.

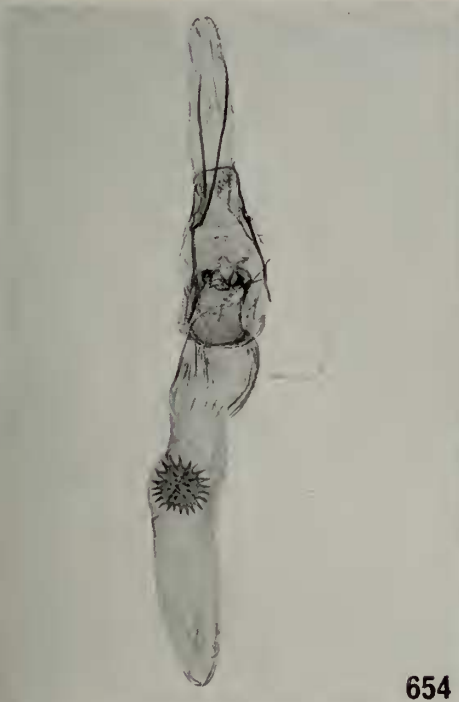
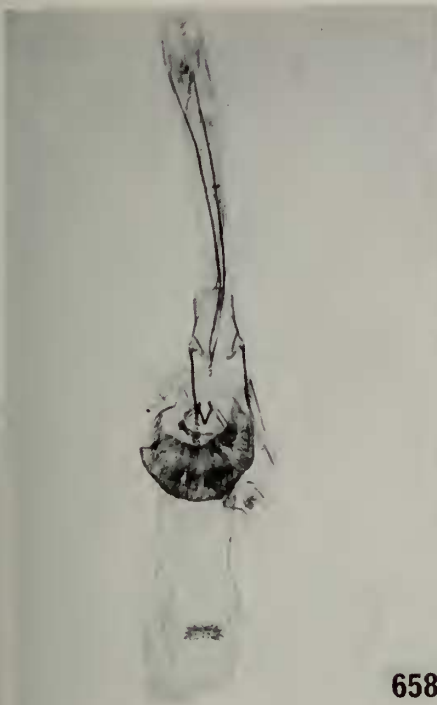


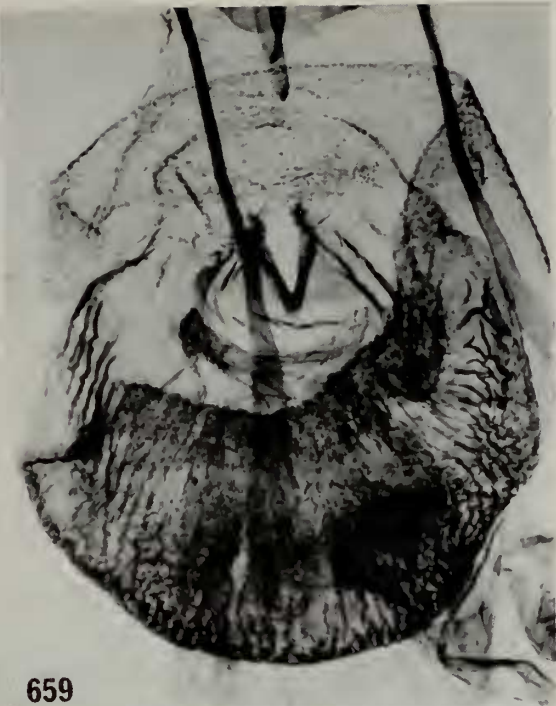
PLATE 52

- FIG. 658. *Zamarada dilucida*, ♀ genitalia.  
FIG. 659. *Z. dilucida*, sterigma.  
FIG. 660. *Z. nasuta*, ♀ genitalia.  
FIG. 661. *Z. nasuta*, sterigma.





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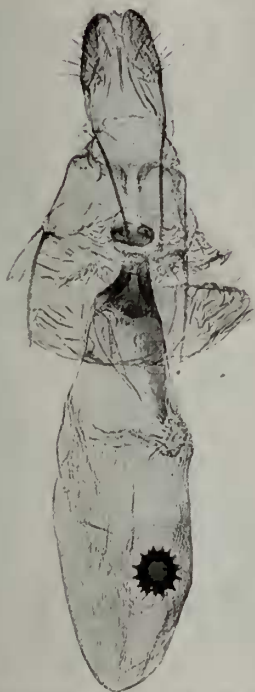
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PLATE 53

- FIG. 662. *Zamarada vulpina*, ♀ genitalia.  
FIG. 663. *Z. vulpina*, sterigma.  
FIG. 664. *Z. bastelbergeri*, ♀ genitalia.  
FIG. 665. *Z. bastelbergeri*, sterigma.



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PLATE 54

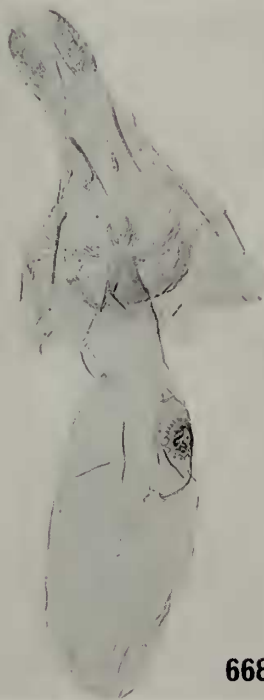
- FIG. 666. *Zamarada dialitha*, ♀ genitalia.  
FIG. 667. *Z. dialitha*, sterigma.  
FIG. 668. *Z. saburra*, ♀ genitalia.  
FIG. 669. *Z. saburra*, sterigma.



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PLATE 55

- FIG. 670. *Zamarada candelabra*, ♀ genitalia.  
FIG. 671. *Z. candelabra*, sterigma.  
FIG. 672. *Z. exigua*, ♀ genitalia.  
FIG. 673. *Z. exigua*, sterigma



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PLATE 56

- FIG. 674. *Zamarada prolata*, ♀ genitalia.  
FIG. 675. *Z. prolata*, sterigma.  
FIG. 676. *Z. ignicosta*, ♀ genitalia.  
FIG. 677. *Z. ignicosta*, sterigma.



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PLATE 57

- FIG. 678. *Zamarada flavicaput*, ♀ genitalia.  
FIG. 679. *Z. flavicaput*, sterigma.  
FIG. 680. *Z. gracilata*, ♀ genitalia.  
FIG. 681. *Z. gracilata*, sterigma.





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PLATE 58

- FIG. 682. *Zamarada scintillans*, ♀ genitalia.  
FIG. 683. *Z. scintillans*, sterigma.  
FIG. 684. *Z. euphrosyne*, ♀ genitalia.  
FIG. 685. *Z. euphrosyne*, sterigma.



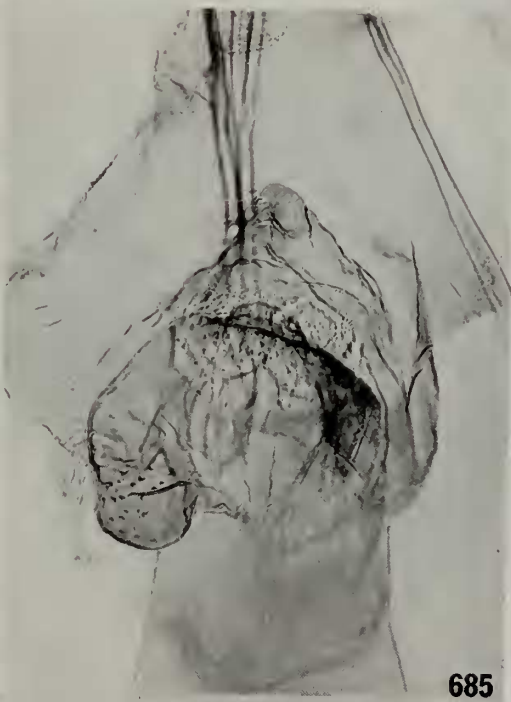
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PLATE 59

- FIG. 686. *Zamarada denticatella*, ♀ genitalia.  
FIG. 687. *Z. denticatella*, sterigma.  
FIG. 688. *Z. densisparsa*, ♀ genitalia.  
FIG. 689. *Z. densisparsa*, sterigma.

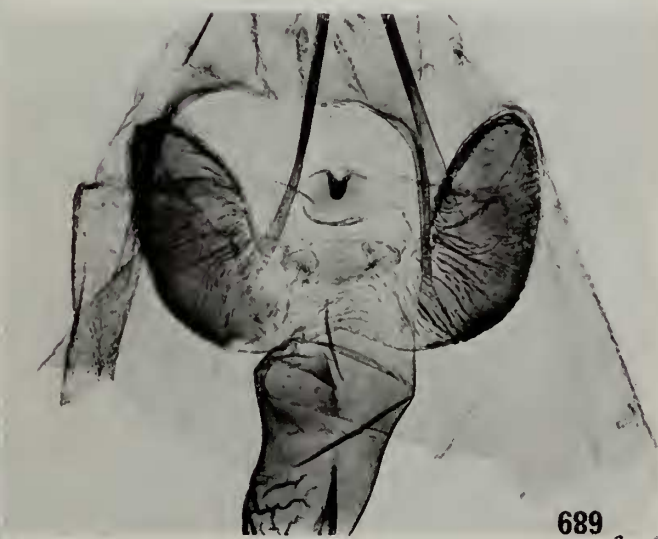
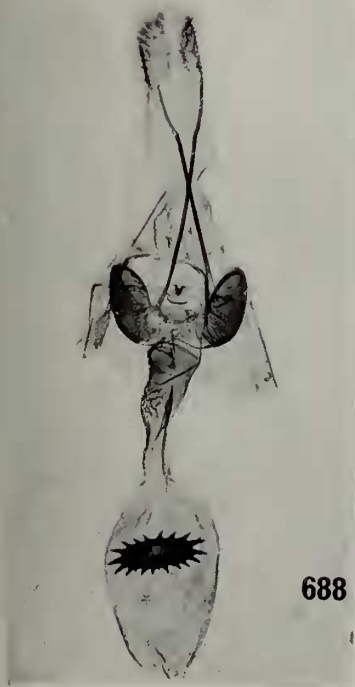
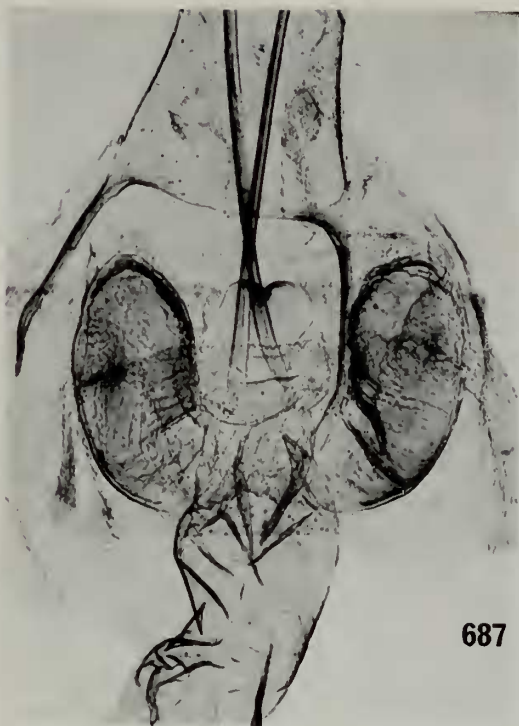




PLATE 60

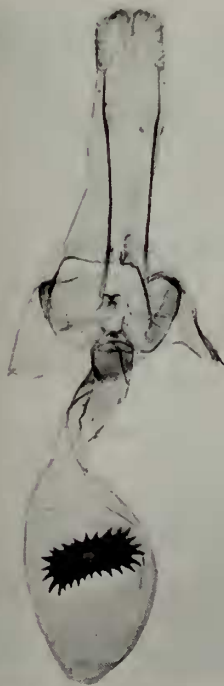
- FIG. 690. *Zamarada fessa*, ♀ genitalia.  
FIG. 691. *Z. fessa*, sterigma.  
FIG. 692. *Z. eroessa*, ♀ genitalia.  
FIG. 693. *Z. eroessa*, sterigma.



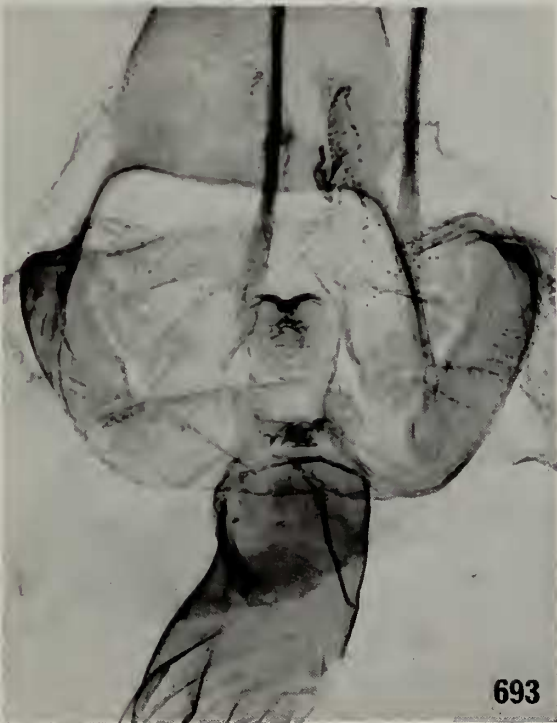
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PLATE 61

- FIG. 694. *Zamarada euterpina*, ♀ genitalia.  
FIG. 695. *Z. euterpina*, sterigma.  
FIG. 696. *Z. dorsiplaga*, ♀ genitalia.  
FIG. 697. *Z. dorsiplaga*, sterigma.



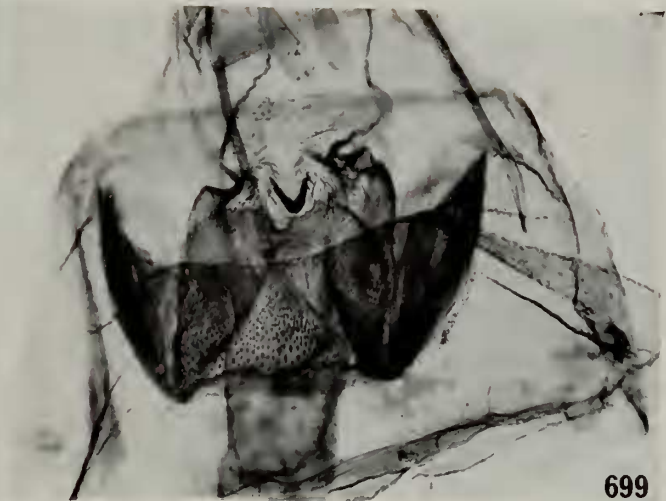
PLATE 62

- FIG. 698. *Zamarada metrioscaphes*, ♀ genitalia.  
FIG. 699. *Z. metrioscaphes*, sterigma.  
FIG. 700. *Z. seydeli*, ♀ genitalia.  
FIG. 701. *Z. seydeli*, sterigma.





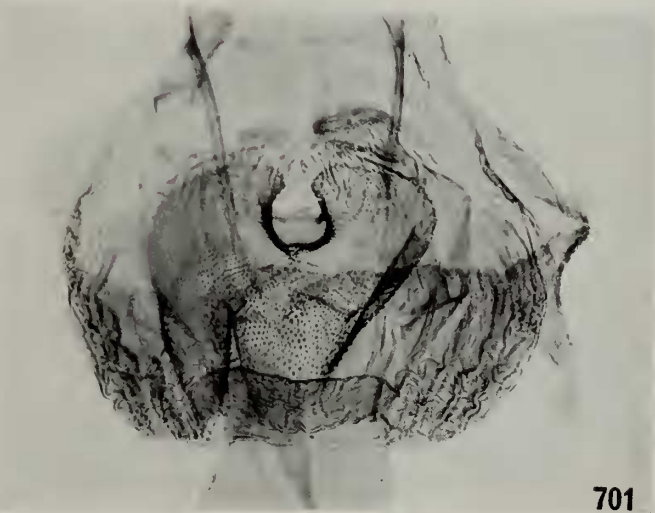
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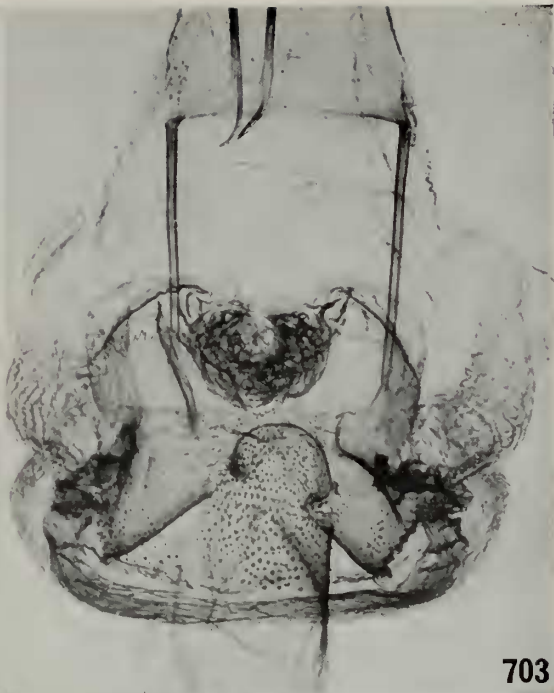
701

PLATE 63

- FIG. 702. *Zamarada glareosa*, ♀ genitalia.  
FIG. 703. *Z. glareosa*, sterigma.  
FIG. 704. *Z. rubrifascia*, ♀ genitalia.  
FIG. 705. *Z. rubrifascia*, sterigma.



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PLATE 64

FIG. 706. *Zamarada plana*, ♀ genitalia.

FIG. 707. *Z. plana*, sterigma.

FIG. 708. *Z. varii*, ♀ genitalia.

FIG. 709. *Z. varii*, sterigma.

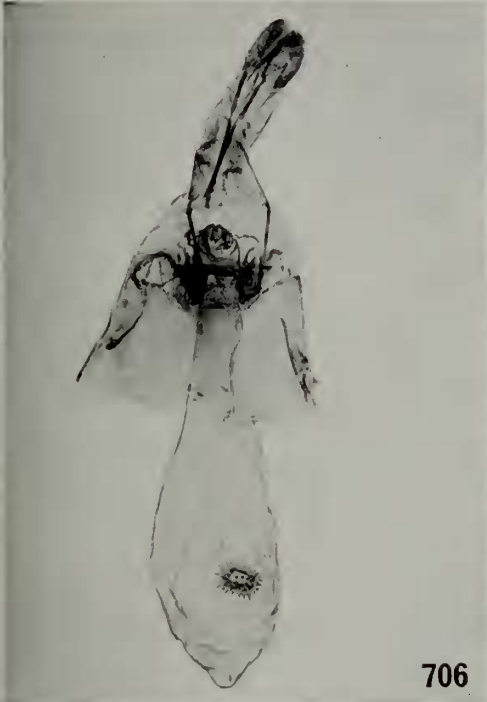




PLATE 65

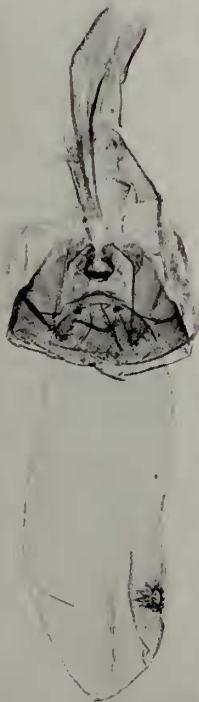
- FIG. 710. *Zamarada astyphela*, ♀ genitalia.  
FIG. 711. *Z. astyphela*, sterigma.  
FIG. 712. *Z. griseola*, ♀ genitalia.  
FIG. 713. *Z. griseola*, sterigma.



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PLATE 66

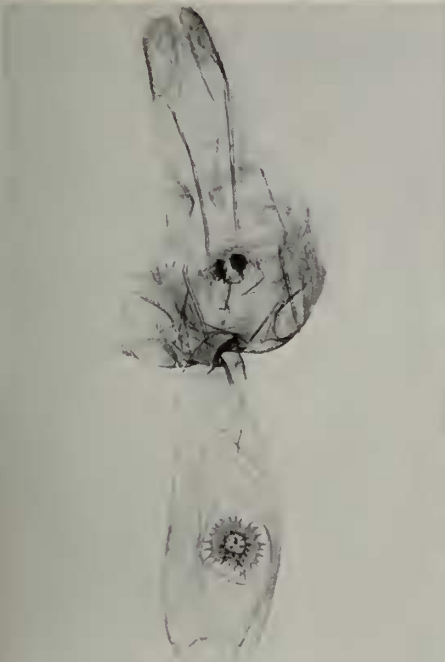
- FIG. 714. *Zamarada euerces*, ♀ genitalia.  
FIG. 715. *Z. euerces*, sterigma.  
FIG. 716. *Z. fumosa*, ♀ genitalia.  
FIG. 717. *Z. fumosa*, sterigma.



PLATE 67

- FIG. 718. *Zamarada cathetus*, ♀ genitalia.  
FIG. 719. *Z. cathetus*, sterigma.  
FIG. 720. *Z. unisona*, ♀ genitalia.  
FIG. 721. *Z. unisona*, sterigma.





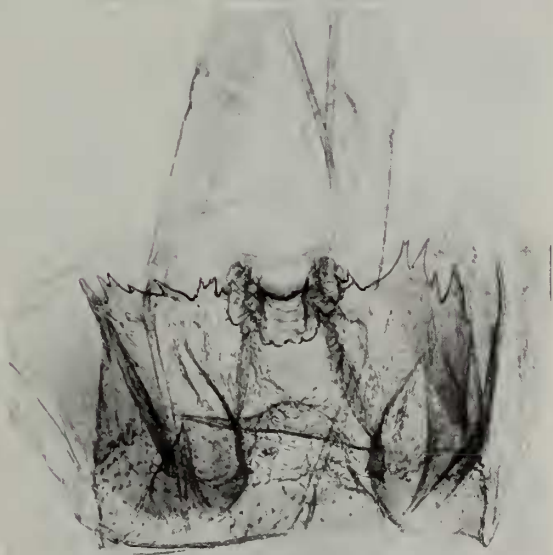
718



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PLATE 68

- FIG. 722. *Zamarada phrontisaria*, ♀ genitalia.  
FIG. 723. *Z. phrontisaria*, sterigma.  
FIG. 724. *Z. rufilinearia*, ♀ genitalia.  
FIG. 725. *Z. rufilinearia*, sterigma.



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PLATE 69

- FIG. 726. *Zamarada acosmeta*, ♀ genitalia.  
FIG. 727. *Z. acosmeta*, sterigma.  
FIG. 728. *Z. pinheyi*, ♀ genitalia.  
FIG. 729. *Z. pinheyi*, sterigma.





PLATE 70

- FIG. 730. *Zamarada labifera labifera*, ♀ genitalia.  
FIG. 731. *Z. labifera labifera*, sterigma.  
FIG. 732. *Z. labifera discata*, ♀ genitalia.  
FIG. 733. *Z. labifera discata*, sterigma.

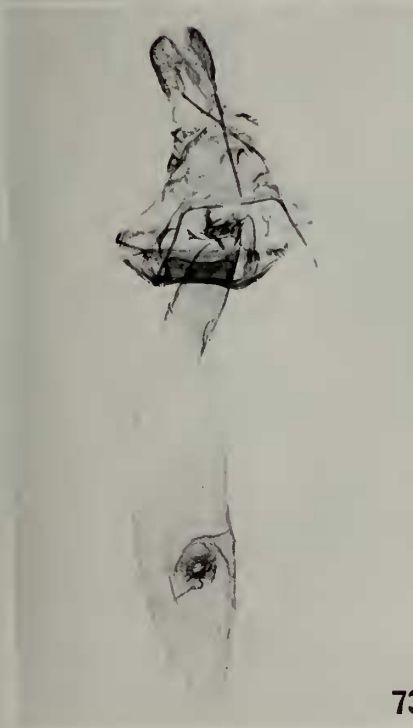
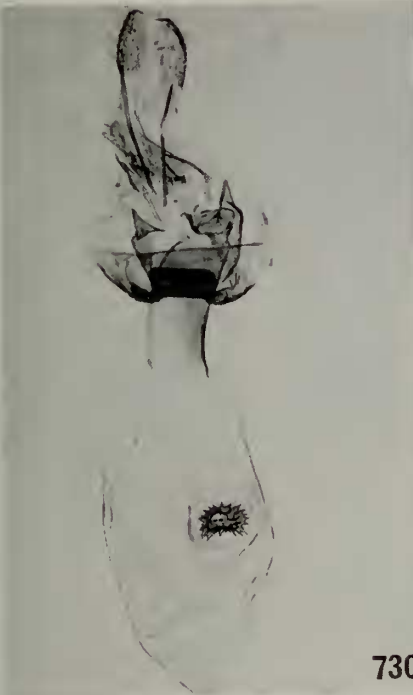


PLATE 71

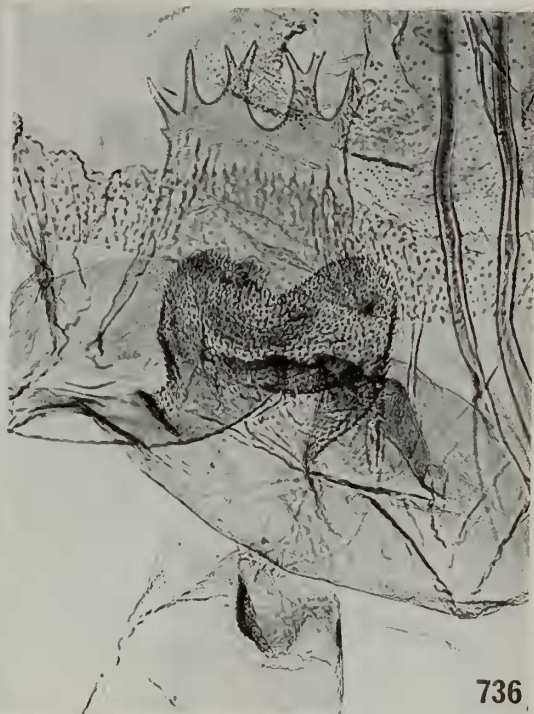
- FIG. 734. *Zamarada adumbrata*, ♀ genitalia.  
FIG. 735. *Z. cydippe*, ♀ genitalia.  
FIG. 736. *Z. cydippe*, sterigma.  
FIG. 737. *Z. adumbrata*, sterigma.  
FIG. 738. *Z. adumbrata*, sterigma.



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PLATE 72

- FIG. 739. *Zamarada dilata*, ♀ genitalia.  
FIG. 740. *Z. dilata*, sterigma.  
FIG. 741. *Z. clenchi*, ♀ genitalia.  
FIG. 742. *Z. clenchi*, sterigma.





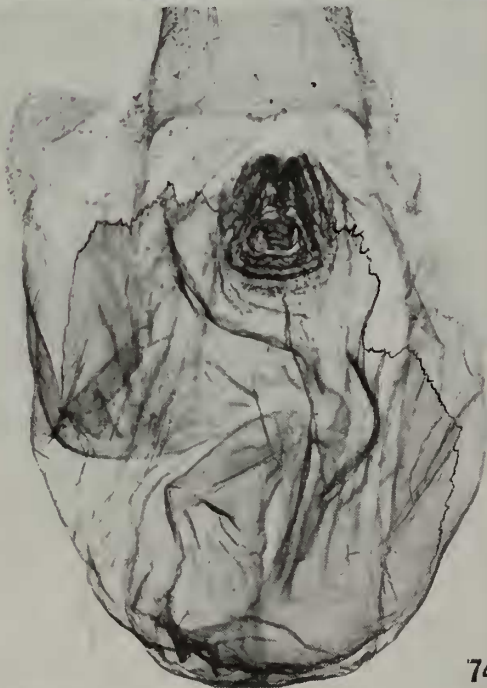
739



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PLATE 73

- FIG. 743. *Zamarada acrochra*, ♀ genitalia.  
FIG. 744. *Z. acrochra*, sterigma.  
FIG. 745. *Z. auratisquama*, ♀ genitalia.  
FIG. 746. *Z. auratisquama*, sterigma.



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PLATE 74

- FIG. 747. *Zamarada platycephala*, ♀ genitalia.  
FIG. 748. *Z. principis*, ♀ genitalia.  
FIG. 749. *Z. principis*, sterigma.  
FIG. 750. *Z. platycephala*, sterigma.  
FIG. 751. *Z. platycephala*, sterigma.

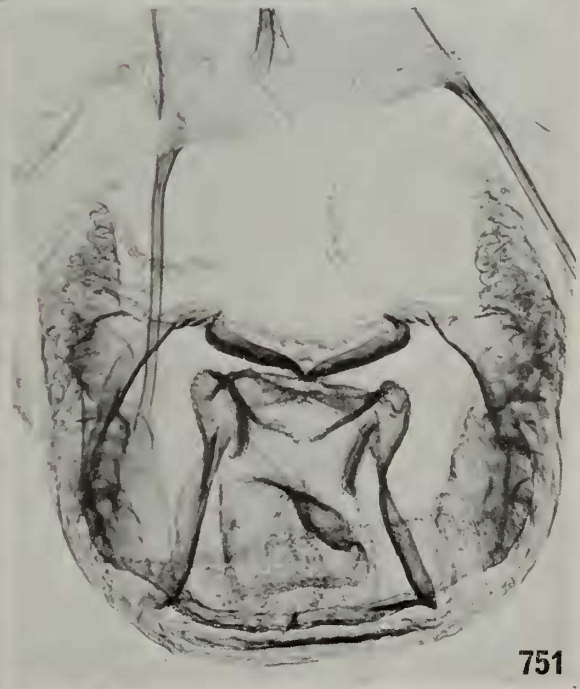
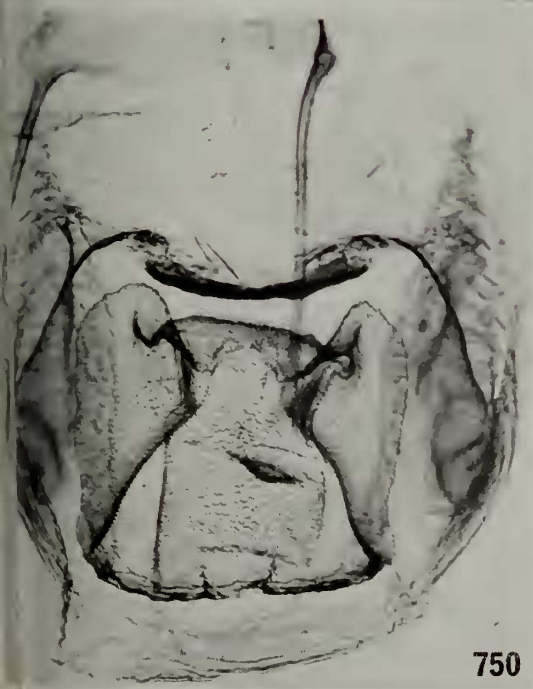
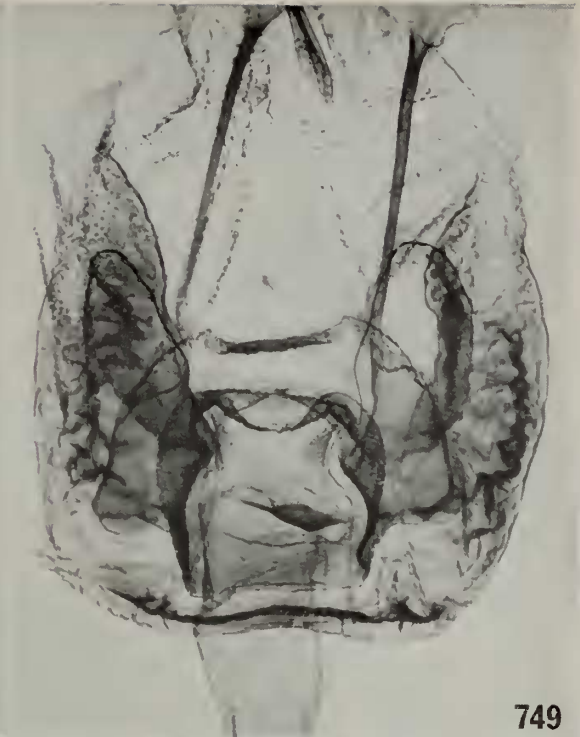
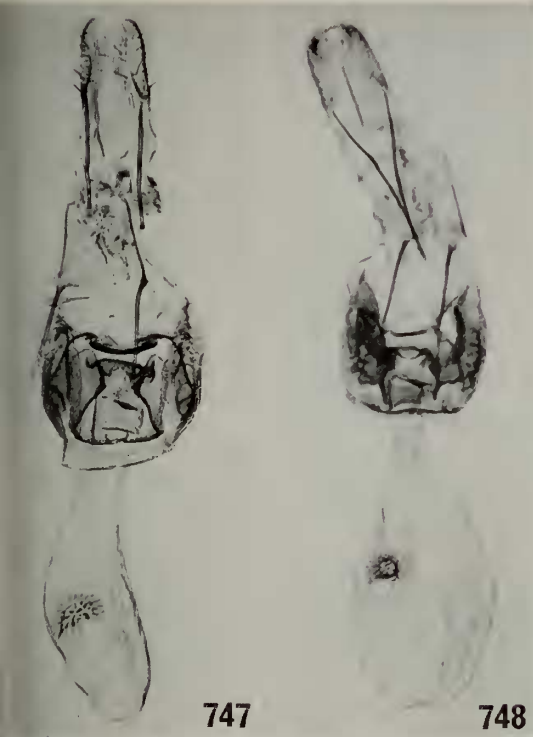




PLATE 75

- FIG. 752. *Zamarada clavigera*, ♀ genitalia.  
FIG. 753. *Z. bicuspidata*, ♀ genitalia.  
FIG. 754. *Z. bicuspidata*, sterigma.  
FIG. 755. *Z. clavigera*, sterigma.  
FIG. 756. *Z. platycephala*, sterigma.

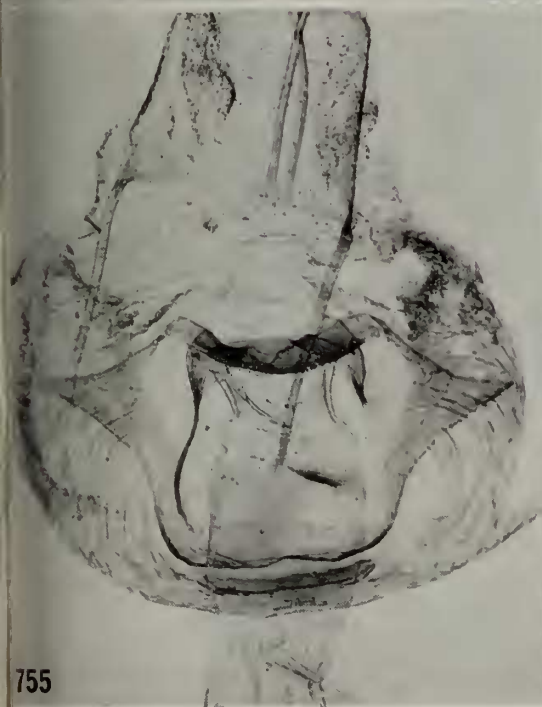
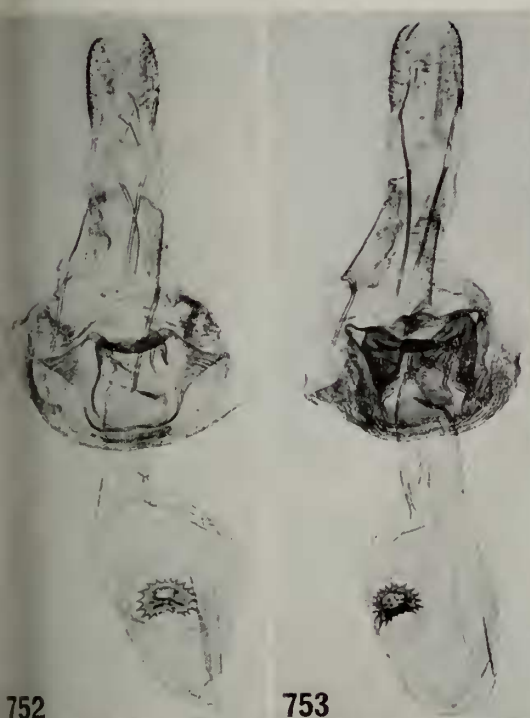


PLATE 76

- FIG. 757. *Zamarada lima*, ♀ genitalia.  
FIG. 758. *Z. lima*, sterigma.  
FIG. 759. *Z. gamma*, ♀ genitalia.  
FIG. 760. *Z. gamma*, sterigma.



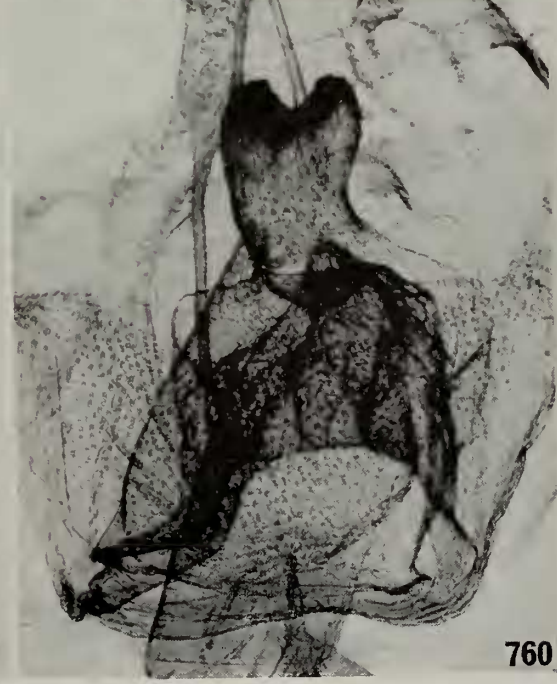
757



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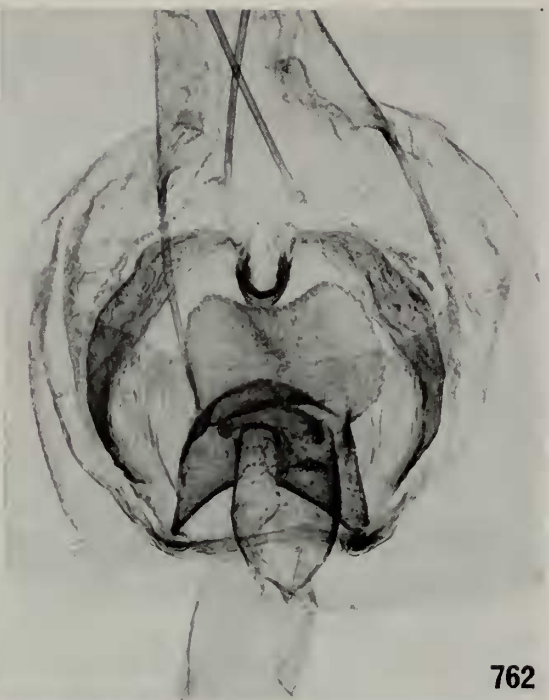
PLATE 77

- FIG. 761. *Zamarada subincoloris* ♀ genitalia.  
FIG. 762. *Z. subincoloris*, sterigma.  
FIG. 763. *Z. corroborata*, ♀ genitalia.  
FIG. 764. *Z. corroborata*, sterigma.





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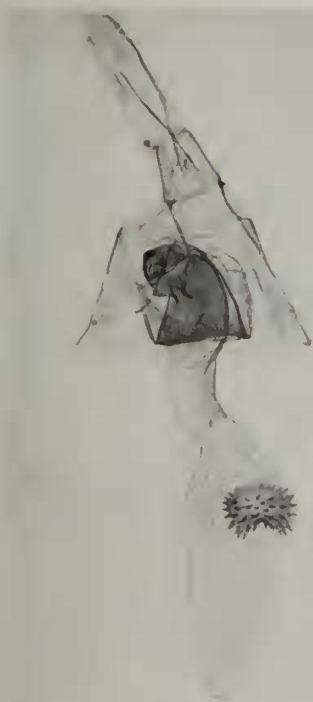
763



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PLATE 78

- FIG. 765. *Zamarada clio*, ♀ genitalia.  
FIG. 766. *Z. clio*, sterigma.  
FIG. 767. *Z. aurolineata*, ♀ genitalia  
FIG. 768. *Z. aurolineata*, sterigma.



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PLATE 79

- FIG. 769. *Zamarada herbuloti*, ♀ genitalia.  
FIG. 770. *Z. herbuloti*, sterigma.  
FIG. 771. *Z. opala*, ♀ genitalia.  
FIG. 772. *Z. opala*, sterigma.



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PLATE 80

- FIG. 773. *Zamarada bonaberiensis*, ♀ genitalia.  
FIG. 774. *Z. bonaberiensis*, sterigma.  
FIG. 775. *Z. collarti*, ♀ genitalia.  
FIG. 776. *Z. collarti*, sterigma.



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PLATE 81

- FIG. 777. *Zamarada vigilans*, ♀ genitalia.  
FIG. 778. *Z. vigilans*, sterigma.  
FIG. 779. *Z. perlepidata*, ♀ genitalia.  
FIG. 780. *Z. perlepidata*, sterigma.



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PLATE 82

- FIG. 781. *Zamarada terpsichore terpsichore*, ♀ genitalia.  
FIG. 782. *Z. dolorosa*, ♀ genitalia.  
FIG. 783. *Z. dolorosa*, sterigma.  
FIG. 784. *Z. terpsichore terpsichore*, sterigma.  
FIG. 785. *Z. terpsichore aprica*, sterigma.





PLATE 83

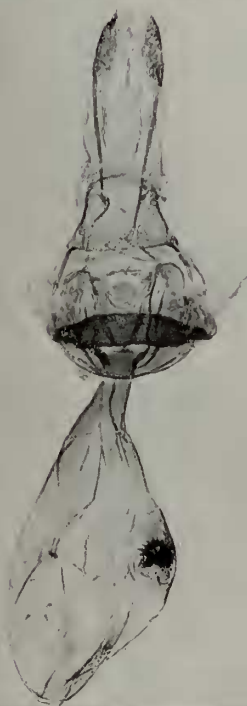
- FIG. 786. *Zamarada rhamphis*, ♀ genitalia.  
FIG. 787. *Z. rhamphis*, sterigma.  
FIG. 788. *Z. cucharita*, ♀ genitalia.  
FIG. 789. *Z. cucharita*, sterigma.



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PLATE 84

- FIG. 790. *Zamarada reflexaria*, ♀ genitalia.  
FIG. 791. *Z. reflexaria*, sterigma.  
FIG. 792. *Z. ixiaria*, ♀ genitalia.  
FIG. 793. *Z. ixiaria*, sterigma.



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PLATE 85

- FIG. 794. *Zamarada crenulata*, ♀ genitalia.  
FIG. 795. *Z. crenulata*, sterigma.  
FIG. 796. *Z. erosa*, ♀ genitalia.  
FIG. 797. *Z. erosa*, sterigma.

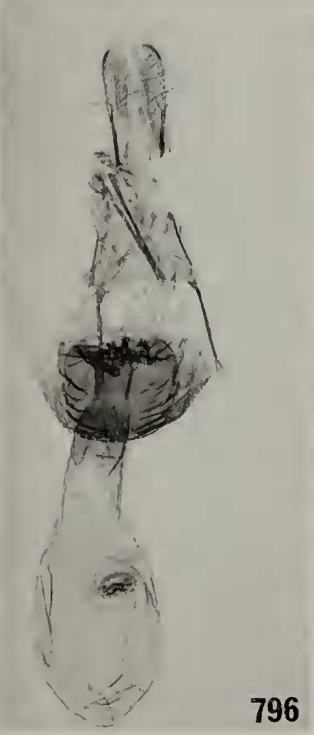
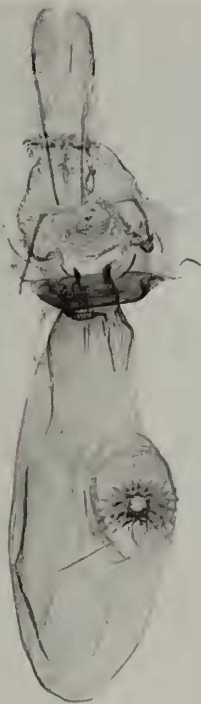


PLATE 86

- FIG. 798. *Zamarada latimargo*, ♀ genitalia  
FIG. 799. *Z. latimargo*, sterigma.  
FIG. 800. *Z. janata*, ♀ genitalia.  
FIG. 801. *Z. janata*, sterigma.



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PLATE 87

- FIG. 802. *Zamarada crystallophana*, ♀ genitalia.  
FIG. 803. *Z. leona*, ♀ genitalia.  
FIG. 804. *Z. leona*, sterigma.  
FIG. 805. *Z. crystallophana*, sterigma. Ivory Coast.  
FIG. 806. *Z. crystallophana*, sterigma. Mozambique.



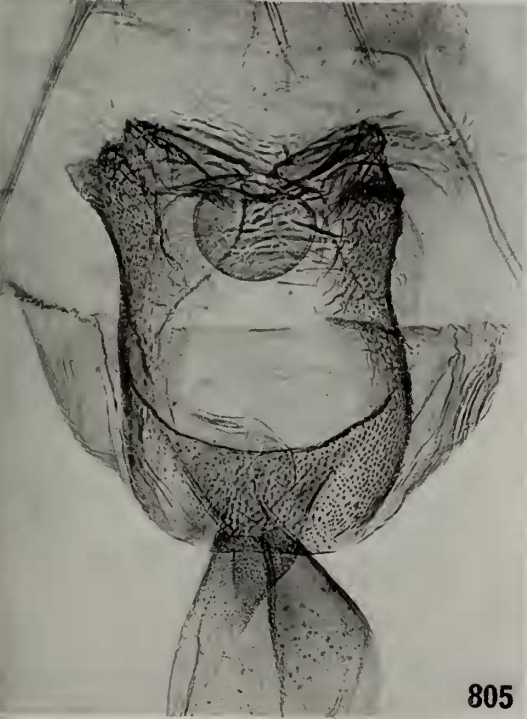
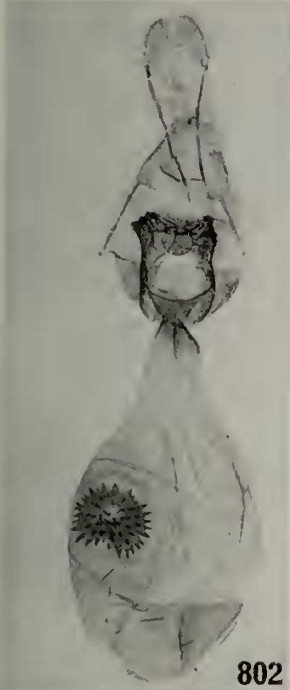


PLATE 88

- FIG. 807. *Zamarada paxilla*, ♀ genitalia.  
FIG. 808. *Z. emaciata*, ♀ genitalia.  
FIG. 809. *Z. emaciata*, sterigma.  
FIG. 810. *Z. paxilla*, sterigma.  
FIG. 811. *Z. paxilla*, sterigma.

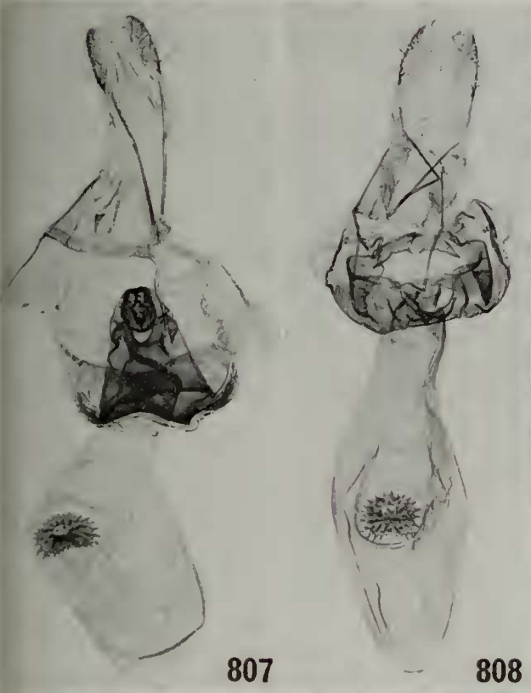


PLATE 89

FIG. 812. *Zamarada tullia*, ♀ genitalia.

FIG. 813. *Z. tullia*, sterigma.

FIG. 814. *Z. sagitta*, ♀ genitalia.

FIG. 815. *Z. sagitta*, sterigma.





PLATE 90

- FIG. 816. *Zamarada tortura*, ♀ genitalia.  
FIG. 817. *Z. tortura*, sterigma.  
FIG. 818. *Z. pelobasis*, ♀ genitalia.  
FIG. 819. *Z. pelobasis*, sterigma.

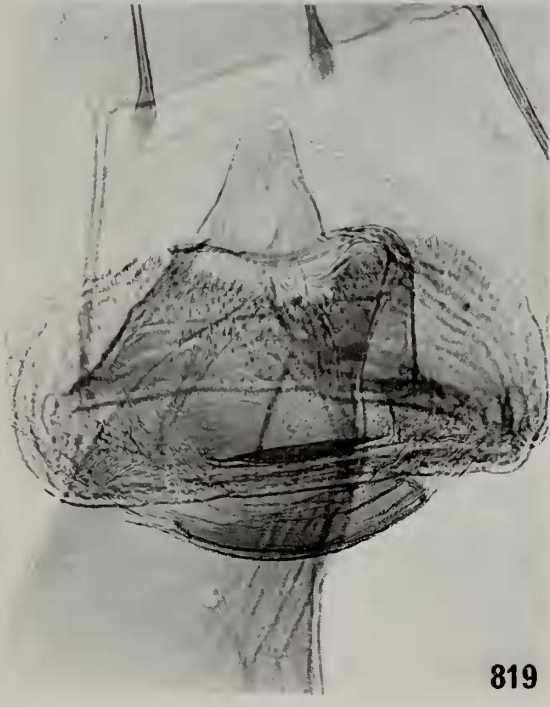


PLATE 91

- FIG. 820. *Zamarada eryma*, ♀ genitalia.  
FIG. 821. *Z. eryma*, sterigma.  
FIG. 822. *Z. eucharis*, ♀ genitalia.  
FIG. 823. *Z. eucharis*, sterigma.

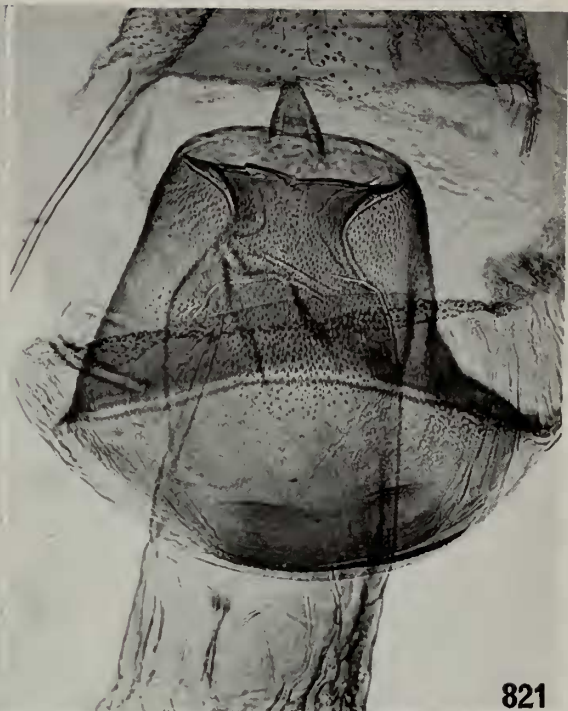
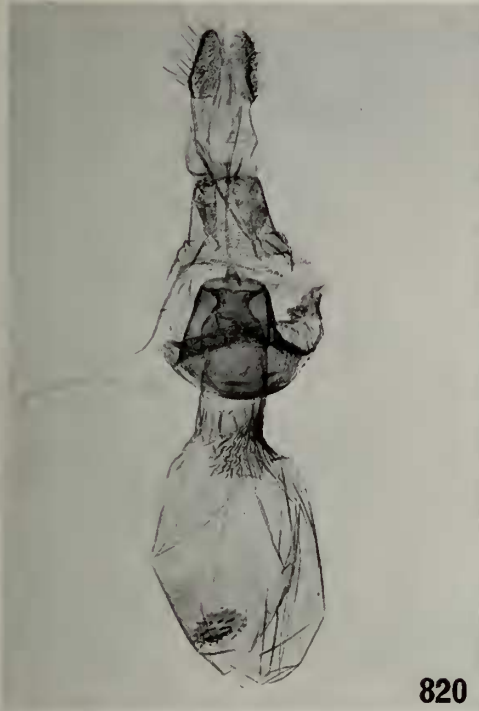


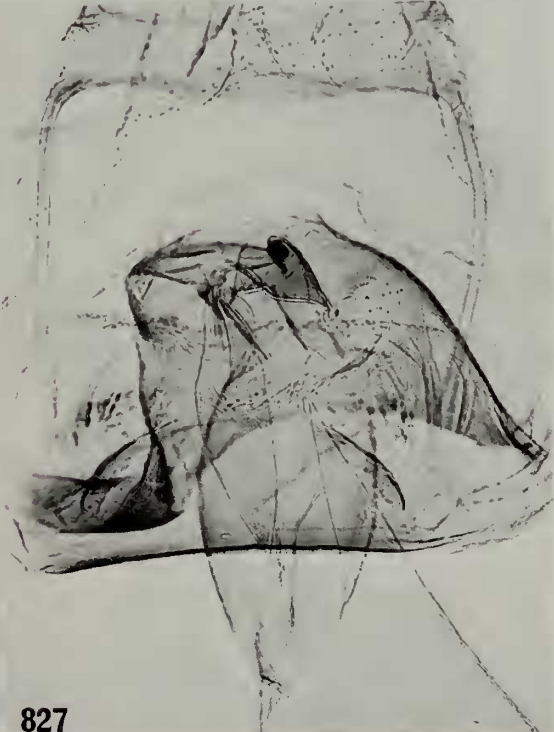
PLATE 92

- FIG. 824. *Zamarada volsella*, ♀ genitalia.  
FIG. 825. *Z. volsella*, sterigma.  
FIG. 826. *Z. deformata*, ♀ genitalia.  
FIG. 827. *Z. deformata*, sterigma.





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PLATE 93

- FIG. 828. *Zamarada mimesis*, ♀ genitalia.  
FIG. 829. *Z. mimesis*, sterigma.  
FIG. 830. *Z. variola*, ♀ genitalia.  
FIG. 831. *Z. variola*, sterigma.

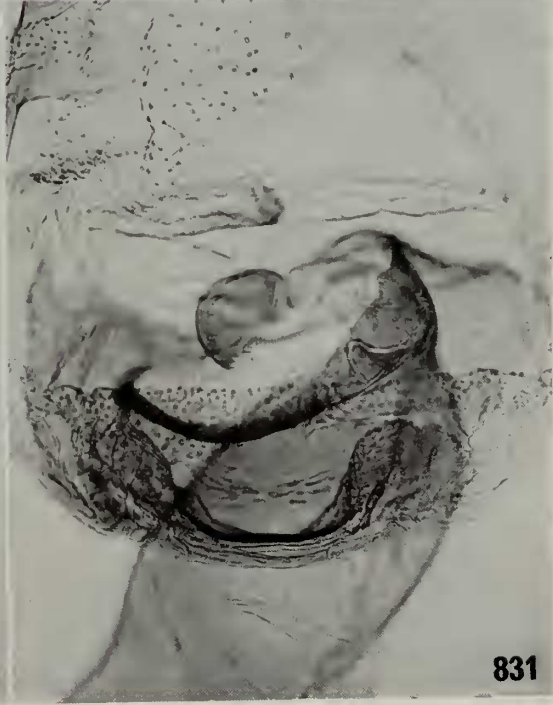
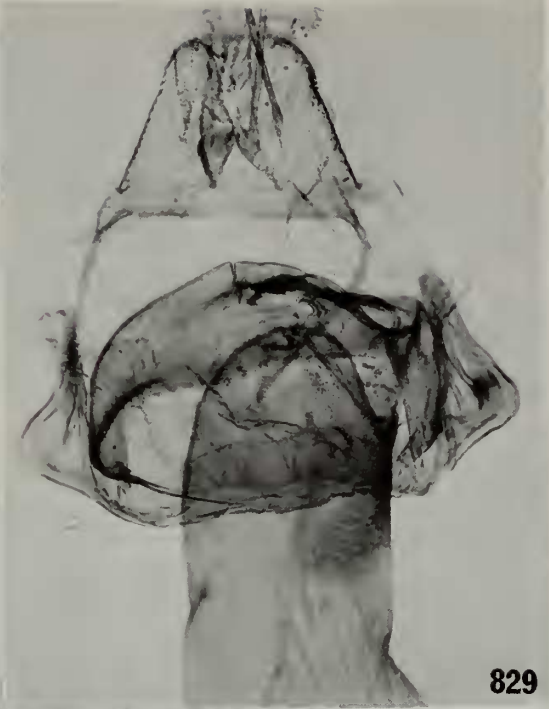


PLATE 94

- FIG. 832. *Zamarada catori*, ♀ genitalia.  
FIG. 833. *Z. catori*, sterigma.  
FIG. 834. *Z. catori*, sterigma.  
FIG. 835. *Z. carcassoni*, ♂ genitalia showing densely scaled dorsal surface of valves.  
FIG. 836. *Z. tortura*, ♂ genitalia showing densely scaled coremata.

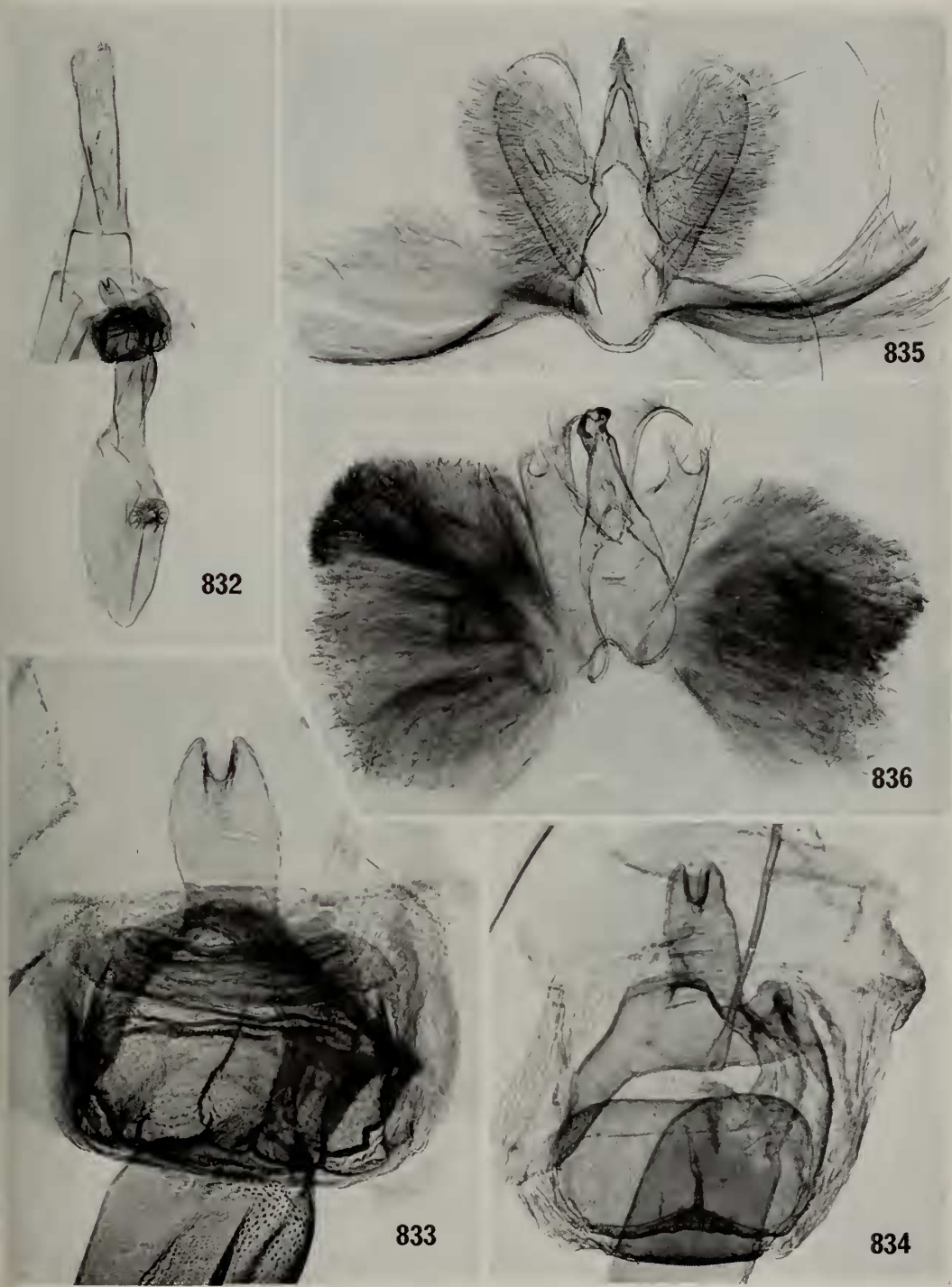




PLATE 95

- FIG. 837. *Zamarada keraia*, paratype ♂.  
FIG. 838. *Z. keraia*, paratype ♀.  
FIG. 839. *Z. ekphysis*, paratype ♀.  
FIG. 840. *Z. inermis*, paratype ♀.  
FIG. 841. *Z. ansorgei*, ♂.  
FIG. 842. *Z. latilimbata*, ♀.  
FIG. 843. *Z. minimaria minimaria*, ♂.  
FIG. 844. *Z. minimaria minimaria*, ♂.  
FIG. 845. *Z. minimaria arenosa*, holotype ♂.  
FIG. 846. *Z. minimaria arenosa*, paratype ♀.  
FIG. 847. *Z. anacantha*, paratype ♀.  
FIG. 848. *Z. phaeozona*, ♀.  
(All × 2)



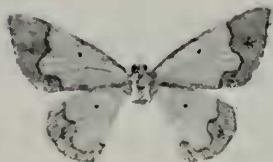
837



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PLATE 96

- FIG. 849. *Zamarada townsendi*, paratype ♂.  
FIG. 850. *Z. townsendi*, paratype ♀.  
FIG. 851. *Z. townsendi*, paratype ♀.  
FIG. 852. *Z. eurygnathus*, holotype ♂.  
FIG. 853. *Z. aureomarginata*, ♂.  
FIG. 854. *Z. aureomarginata*, ♀.  
FIG. 855. *Z. labrys*, paratype ♀.  
FIG. 856. *Z. mesotaenia*, ♂.  
FIG. 857. *Z. consecuta*, holotype ♂.  
FIG. 858. *Z. consecuta*, paratype ♀.  
(All  $\times 2$ )



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PLATE 97

- FIG. 859. *Zamarada deceptrix*, ♂.  
FIG. 860. *Z. deceptrix*, ♀.  
FIG. 861. *Z. deceptrix*, ♂.  
FIG. 862. *Z. chrysothyra*, holotype ♂.  
FIG. 863. *Z. secutaria*, holotype ♀.  
FIG. 864. *Z. amicta*, lectotype ♂.  
FIG. 865. *Z. ordinaria*, holotype ♂.  
FIG. 866. *Z. ordinaria*, ♀ (*Z. medianata*, holotype ♀).  
FIG. 867. *Z. erugata*, paratype ♂.  
FIG. 868. *Z. prionotos*, paratype ♂.  
(All  $\times 2$ )





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PLATE 98

- FIG. 869. *Zamarada metallicata*, ♂.  
FIG. 870. *Z. pulverosa*, ♂.  
FIG. 871. *Z. pulverosa*, ♂.  
FIG. 872. *Z. pulverosa*, ♀.  
FIG. 873. *Z. ascapbes*, ♂.  
FIG. 874. *Z. torrida*, paratype ♀.  
FIG. 875. *Z. tosta*, paratype ♀.  
FIG. 876. *Z. delta*, paratype ♂.  
FIG. 877. *Z. psammites*, ♂.  
FIG. 878. *Z. psammites*, paratype ♀.  
(All  $\times 2$ )



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PLATE 99

- FIG. 879. *Zamarada hyalinaria*, ♂.  
FIG. 880. *Z. hyalinaria*, ♀.  
FIG. 881. *Z. ochrata*, ♂.  
FIG. 882. *Z. ochrata*, ♂.  
FIG. 883. *Z. ochrata*, ♀.  
FIG. 884. *Z. ochrata*, ♀.  
FIG. 885. *Z. melasma*, paratype ♀.  
FIG. 886. *Z. melasma*, paratype ♀.  
FIG. 887. *Z. ilma*, ♂.  
FIG. 888. *Z. ilma*, ♂.  
FIG. 889. *Z. differens*, ♀.  
FIG. 890. *Z. jansei*, paratype ♂.  
(All  $\times 2$ )



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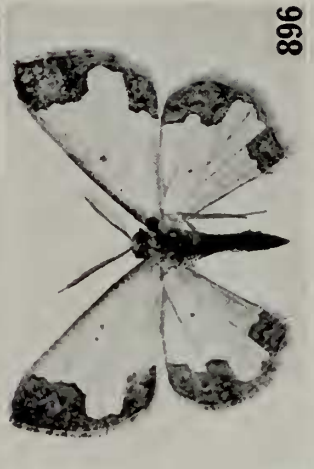


PLATE 100

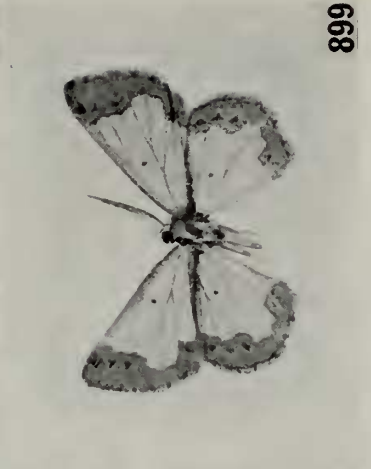
- FIG. 891. *Zamarada scriptifasciata*, holotype ♀.  
FIG. 892. *Z. baliata*, ♂.  
FIG. 893. *Z. fugax*, holotype ♀.  
FIG. 894. *Z. denticulata*, holotype ♂.  
FIG. 895. *Z. symmetra*, ♂.  
FIG. 896. *Z. symmetra*, ♂.  
FIG. 897. *Z. excisa*, ♂.  
FIG. 898. *Z. excisa*, ♂.  
FIG. 899. *Z. viettei*, paratype ♂.  
(All × 2)



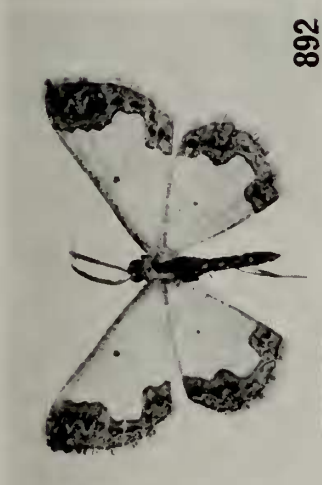
893



896



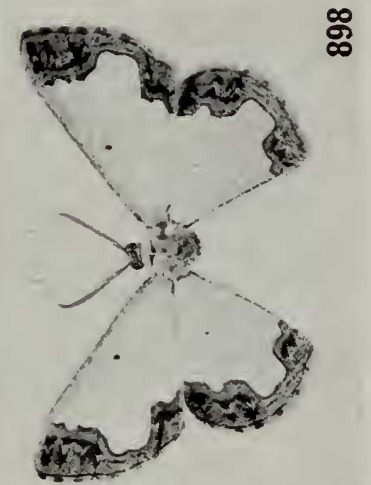
899



892



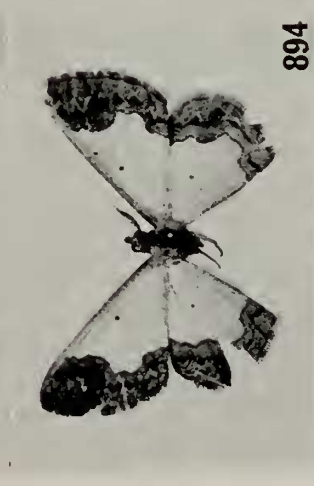
895



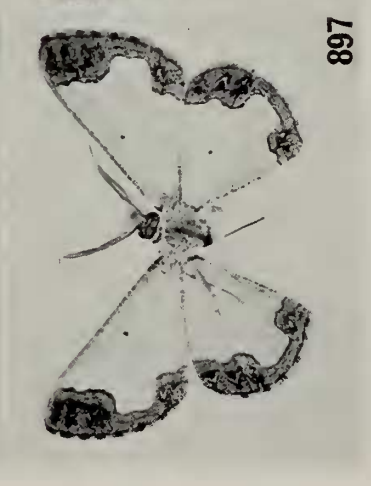
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894



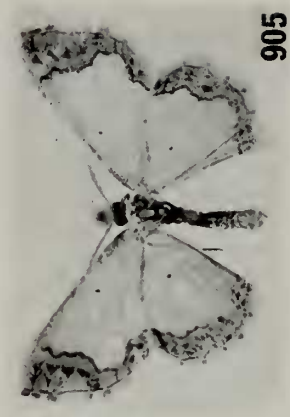
897

PLATE 101

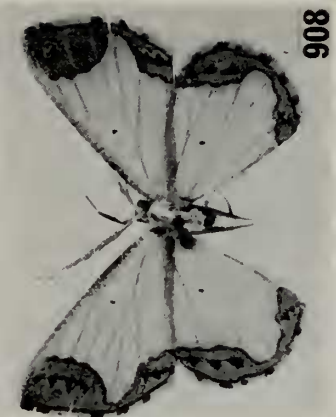
- FIG. 900. *Zamarada eogenaria eogenaria*, ♂.  
FIG. 901. *Z. eogenaria cosmiaria*, ♂.  
FIG. 902. *Z. eogenaria cosmiaria* ab. *tenuimargo*, ♂.  
FIG. 903. *Z. nesiotica*, paratype ♂.  
FIG. 904. *Z. nesiotica*, paratype ♀.  
FIG. 905. *Z. ucata*, paratype ♂.  
FIG. 906. *Z. flavicosta*, ♂ Entebbe.  
FIG. 907. *Z. flavicosta*, ♂ Lagos.  
FIG. 908. *Z. schalida*, holotype ♂.  
(All × 2)



902



905



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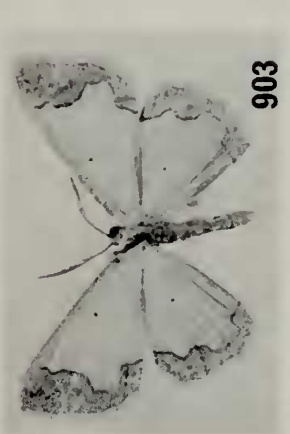
904



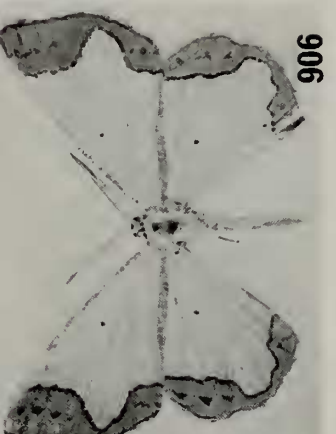
907



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903



906

PLATE 102

- FIG. 909. *Zamarada regularis regularis*, paratype ♂.  
FIG. 910. *Z. regularis arcuata*, paratype ♀.  
FIG. 911. *Z. pringlei*, paratype ♀.  
FIG. 912. *Z. episema*, paratype ♂.  
FIG. 913. *Z. excavata*, ♂.  
FIG. 914. *Z. dentata*, paratype ♂.  
FIG. 915. *Z. dyscapna*, paratype ♀.  
FIG. 916. *Z. radula*, holotype ♂.  
FIG. 917. *Z. radula*, paratype ♂.  
(All × 2)



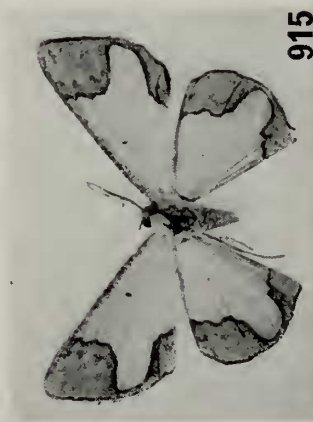
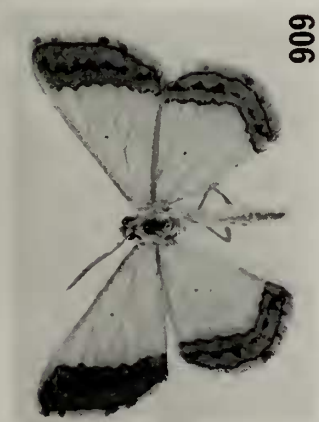
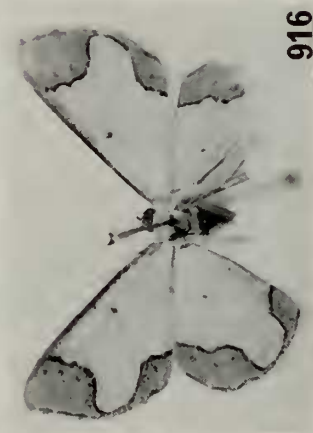
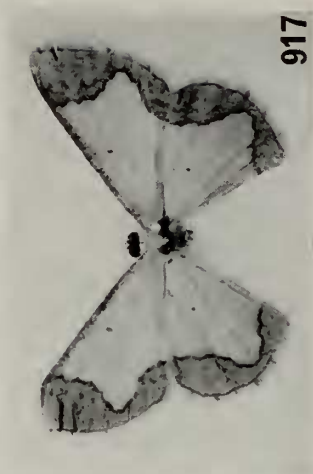


PLATE 103

- FIG. 918. *Zamarada laciniata*, holotype ♂.  
FIG. 919. *Z. dasysceles*, paratype ♂.  
FIG. 920. *Z. sicula*, holotype ♂.  
FIG. 921. *Z. fusticula*, paratype ♂.  
FIG. 922. *Z. cinereata*, holotype ♂.  
FIG. 923. *Z. hero*, holotype ♂.  
FIG. 924. *Z. manifesta*, paratype ♂.  
FIG. 925. *Z. dargei*, paratype ♂.  
FIG. 926. *Z. corymbophora*, paratype ♂.  
(All  $\times 2$ )

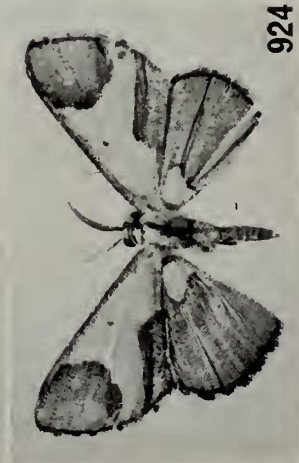


PLATE 104

- FIG. 927. *Zamarada thalia*, holotype ♂.  
FIG. 928. *Z. subinterrupta*, ♂  
FIG. 929. *Z. setosa*, paratype ♀.  
FIG. 930. *Z. melpomene*, ♂.  
FIG. 931. *Z. astales*, ♂.  
FIG. 932. *Z. lophobela*, paratype ♂.  
FIG. 933. *Z. melpomene* ab. *tragodica*, ♂.  
FIG. 934. *Z. astales*, holotype ♂.  
FIG. 935. *Z. actys*, holotype ♂.  
(All × 2)



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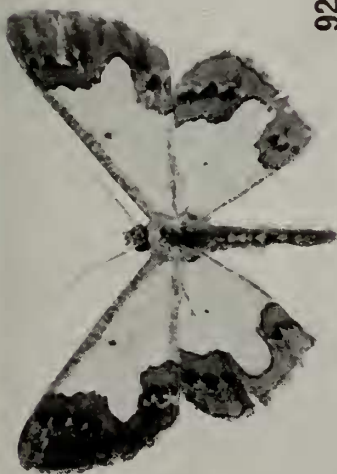
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PLATE 105

- FIG. 936. *Zamarada pentthesis*, holotype ♂.  
FIG. 937. *Z. oxybeles*, paratype ♂.  
FIG. 938. *Z. protrusa*, holotype ♀.  
FIG. 939. *Z. sinecalcarata*, holotype ♂.  
FIG. 940. *Z. carcassoni*, paratype ♂.  
FIG. 941. *Z. lanceolata*, holotype ♂.  
FIG. 942. *Z. antimima*, holotype ♂.  
FIG. 943. *Z. disparata*, paratype ♂.  
FIG. 944. *Z. bernardii*, holotype ♂.  
(All × 2)

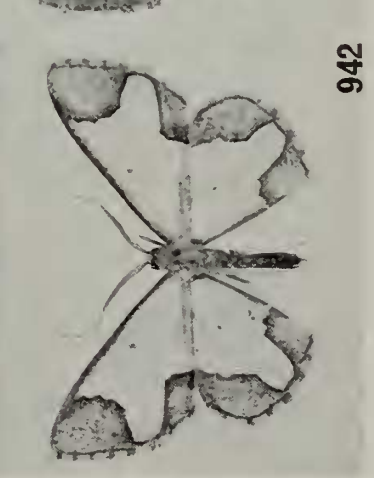
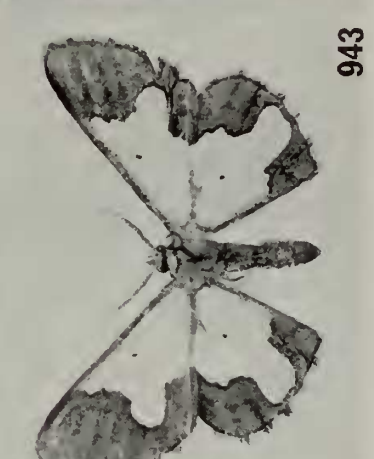
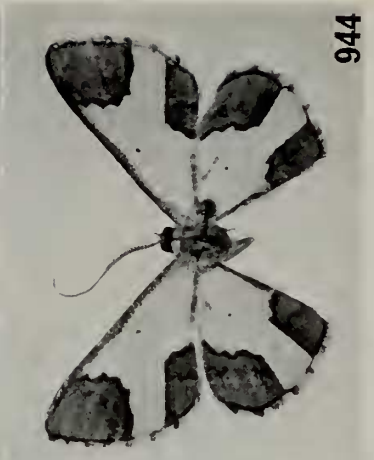


PLATE 106

- FIG. 945. *Zamarada ferruginata*, paratype ♂.  
FIG. 946. *Z. strigilecula*, holotype ♂.  
FIG. 947. *Z. ostracodes*, paratype ♂.  
FIG. 948. *Z. melanopyga*, ♂.  
FIG. 949. *Z. dentigera dentigera*, ♂.  
FIG. 950. *Z. dentigera stenotes*, paratype ♂.  
FIG. 951. *Z. chrysopa*, paratype ♀.  
FIG. 952. *Z. arguta*, paratype ♂.  
FIG. 953. *Z. fibulata*, holotype ♂.  
FIG. 954. *Z. cautela*, paratype ♂.  
(All × 2)



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PLATE 107

- FIG. 955. *Zamarada ilaria*, upperside ♂.  
FIG. 956. *Z. ilaria*, underside ♂.  
FIG. 957. *Z. ariste*, paratype ♂.  
FIG. 958. *Z. erato*, upperside ♂.  
FIG. 959. *Z. erato*, underside ♂.  
FIG. 960. *Z. aglae*, ♂.  
FIG. 961. *Z. phoenopasta*, paratype ♂.  
FIG. 962. *Z. xystra*, paratype ♂.  
FIG. 963. *Z. similis*, holotype ♂.  
FIG. 964. *Z. urania*, holotype ♂.  
(All  $\times 2$ )



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PLATE 108

- FIG. 965. *Zamarada cepa*, paratype ♂.  
FIG. 966. *Z. transvisaria*, ♀.  
FIG. 967. *Z. calypso*, paralectotype ♂.  
FIG. 968. *Z. cepa*, paratype ♀.  
FIG. 969. *Z. gaedei*, holotype ♂.  
FIG. 970. *Z. polycitemon*, ♂.  
FIG. 971. *Z. euryscaphes*, holotype ♀.  
FIG. 972. *Z. gaedei*, paratype ♀.  
FIG. 973. *Z. iobathra*, ♀.  
(All × 2)



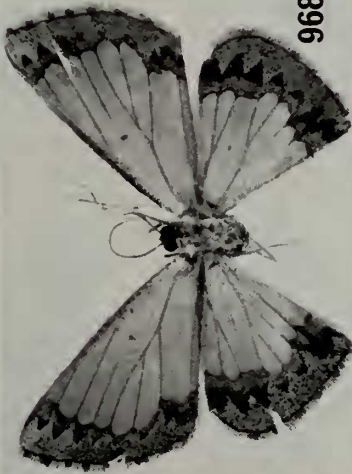
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PLATE 109

- FIG. 974. *Zamarada bathyscaphes*, ♂.  
FIG. 975. *Z. adiposata*, holotype ♀.  
FIG. 976. *Z. aequilumata*, paratype ♂.  
FIG. 977. *Z. odontophora*, holotype ♂.  
FIG. 978. *Z. angustimargo*, holotype ♂.  
FIG. 979. *Z. aclea*, holotype ♀.  
FIG. 980. *Z. purimargo*, ♀.  
FIG. 981. *Z. psi*, paratype ♂.  
FIG. 982. *Z. purimargo*, ♂.  
FIG. 983. *Z. miranda*, holotype ♂.  
(All × 2)



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PLATE 110

- FIG. 984. *Zamarada dilucida*, ♂.  
FIG. 985. *Z. dilucida*, ♂.  
FIG. 986. *Z. suda*, paratype ♂.  
FIG. 987. *Z. lepta*, paratype ♀.  
FIG. 988. *Z. vulpina*, ♂ Cameroun.  
FIG. 989. *Z. vulpina*, ♂ Rhodesia.  
FIG. 990. *Z. longidens*, holotype ♂.  
FIG. 991. *Z. bastelbergeri*, ♀.  
FIG. 992. *Z. saburra*, paratype ♂.  
FIG. 993. *Z. dialitha*, holotype ♂.  
(All × 2)



984



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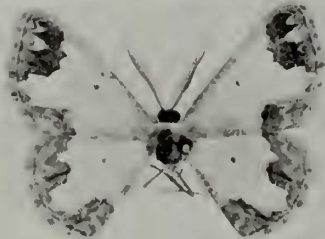
986



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PLATE III

- FIG. 994. *Zamarada candelabra candelabra*, paratype ♀.  
 FIG. 995. *Z. candelabra flexura*, paratype ♂.  
 FIG. 996. *Z. exigua*, paratype ♂.  
 FIG. 997. *Z. prolata*, paratype ♀.  
 FIG. 998. *Z. ignicosta ignicosta*, ♀.  
 FIG. 999. *Z. ignicosta pyrilampes*, ♂.  
 FIG. 1000. *Z. ignicosta pyrilampes* ab. *hemimeres*, holotype ♀.  
 FIG. 1001. *Z. scintillans*, ♂.  
 FIG. 1002. *Z. scintillans*, ♀.  
 FIG. 1003. *Z. flavicaput*, holotype ♀.  
 FIG. 1004. *Z. flavicaput*, ♂.  
 FIG. 1005. *Z. gracilata*, paratype ♀.  
 (All × 2)

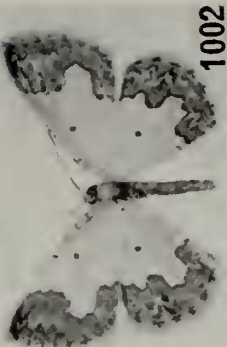


PLATE 112

- FIG. 1006. *Zamarada denticatella*, ♂.  
FIG. 1007. *Z. densisparsa*, ♀.  
FIG. 1008. *Z. eroessa*, holotype ♀.  
FIG. 1009. *Z. fessa*, ♂.  
FIG. 1010. *Z. fessa*, ♀.  
FIG. 1011. *Z. euterpina*, holotype ♀.  
FIG. 1012. *Z. dorsiplaga*, holotype ♀.  
FIG. 1013. *Z. rubrifascia*, paratype ♂.  
FIG. 1014. *Z. rufilinearia*, ♂.  
FIG. 1015. *Z. nasuta*, ♂.  
FIG. 1016. *Z. kompsotes*, holotype ♂.  
FIG. 1017. *Z. euphrosyne*, ♂.

(All × 2)





PLATE 113

- FIG. 1018. *Zamarada metrioscaphes*, lectotype ♂.  
FIG. 1019. *Z. metrioscaphes*, ♂.  
FIG. 1020. *Z. seydeli*, paratype ♂.  
FIG. 1021. *Z. seydeli*, paratype ♀.  
FIG. 1022. *Z. glareosa*, ♂.  
FIG. 1023. *Z. glareosa* ab. *nebulimargo*, ♂.  
FIG. 1024. *Z. varii*, paratype ♂.  
FIG. 1025. *Z. plana denticincta*, ♂.  
FIG. 1026. *Z. plana plana*, lectotype ♂.  
FIG. 1027. *Z. astyphela*, paratype ♂.  
(All × 2)



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PLATE 114

- FIG. 1028. *Zamarada griseola*, holotype ♂.  
FIG. 1029. *Z. euerces*, holotype ♂.  
FIG. 1030. *Z. fumosa*, ♂.  
FIG. 1031. *Z. phrontisaria*, ♂.  
FIG. 1032. *Z. geitaina*, paratype ♂.  
FIG. 1033. *Z. cathetus*, paratype ♀.  
FIG. 1034. *Z. unisona*, holotype ♂.  
FIG. 1035. *Z. pinheyi*, holotype ♂.  
FIG. 1036. *Z. acosmeta*, paratype ♀.  
(All × 2)



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PLATE 115

- FIG. 1037. *Zamarada labifera labifera*, holotype ♂.  
FIG. 1038. *Z. labifera discata*, paratype ♀.  
FIG. 1039. *Z. pristis*, paratype ♂.  
FIG. 1040. *Z. anna*, holotype ♂.  
FIG. 1041. *Z. acrochra*, ♀.  
FIG. 1042. *Z. dilata*, paratype ♂.  
FIG. 1043. *Z. enippe*, holotype ♂.  
FIG. 1044. *Z. clenchi*, paratype ♂.  
(All × 2)



1037



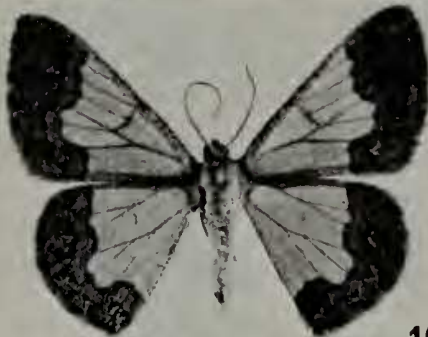
1038



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PLATE 116

FIG. 1045. *Zamarada consummata*, holotype ♂.

FIG. 1046. *Z. aurolineata*, ♂.

FIG. 1047. *Z. corroborata*, ♂.

FIG. 1048. *Z. subincoloris*, ♂.

(All  $\times 2$ )

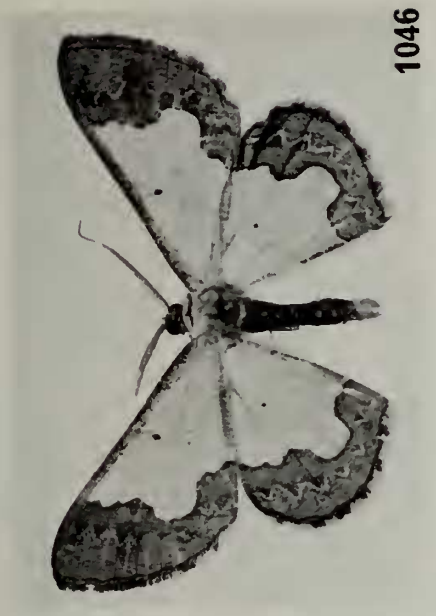
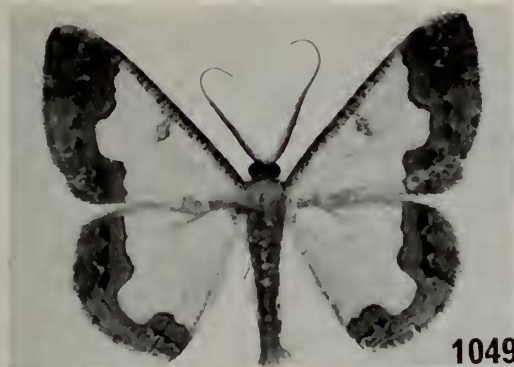


PLATE 117

- FIG. 1049. *Zamarada bicuspidata*, paratype ♂.  
FIG. 1050. *Z. platycephala*, paratype ♂.  
FIG. 1051. *Z. lima*, paratype ♂.  
FIG. 1052. *Z. principis*, holotype ♂.  
FIG. 1053. *Z. onycha*, paratype ♂.  
FIG. 1054. *Z. merga*, holotype ♂.  
FIG. 1055. *Z. tricuspidata*, holotype ♂.  
FIG. 1056. *Z. rupta*, paratype ♂.  
(All  $\times 2$ )





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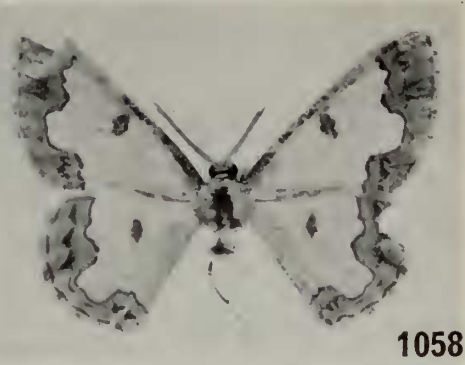
1056

PLATE 118

- FIG. 1057. *Zamarada dione*, paratype ♂.  
FIG. 1058. *Z. xyele*, holotype ♂.  
FIG. 1059. *Z. auratisquama*, ♀.  
FIG. 1060. *Z. gamma*, holotype ♂.  
FIG. 1061. *Z. aerata*, paratype ♂.  
FIG. 1062. *Z. cydippe*, ♂.  
FIG. 1063. *Z. clio*, paralectotype ♂.  
FIG. 1064. *Z. adumbrata*, paratype ♂.  
(All  $\times 2$ )



1057



1058



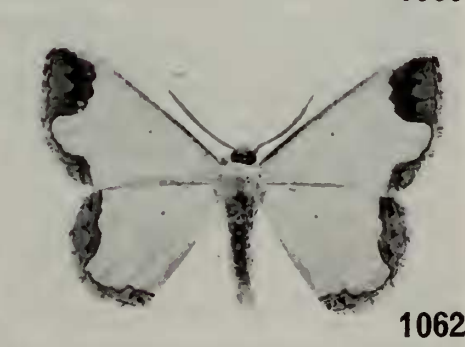
1059



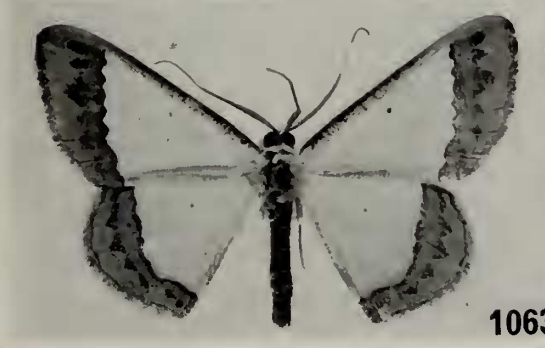
1060



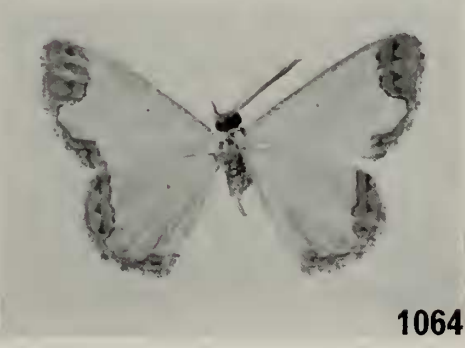
1061



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PLATE 119

- FIG. 1065. *Zamarada undimarginata*, ♂.  
FIG. 1066. *Z. terpsichore terpsichore*, holotype ♂.  
FIG. 1067. *Z. terpsichore compacta*, paratype ♂.  
FIG. 1068. *Z. terpsichore aprica*, paratype ♂.  
FIG. 1069. *Z. dolorosa*, paratype ♂.  
FIG. 1070. *Z. perlepidata*, ♂.  
FIG. 1071. *Z. vigilans*, paratype ♂.  
FIG. 1072. *Z. herbuloti*, paratype ♂.  
(All × 2)



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PLATE 120

- FIG. 1073. *Zamarada bonaberiensis*, lectotype ♂.  
FIG. 1074. *Z. rhamphis*, paratype ♂.  
FIG. 1075. *Z. collarti*, ♂.  
FIG. 1076. *Z. cucharita*, paratype ♂.  
FIG. 1077. *Z. erosa*, paratype ♂.  
FIG. 1078. *Z. reflexaria reflexaria*, ♂.  
FIG. 1079. *Z. ixiaria*, ♂.  
FIG. 1080. *Z. reflexaria aphis*, holotype ♂.  
(All  $\times 2$ )



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1080

PLATE 121

- FIG. 1081. *Zamarada triangularis*, holotype ♂.  
FIG. 1082. *Z. triangularis*, ♂.  
FIG. 1083. *Z. crenulata*, holotype ♂.  
FIG. 1084. *Z. amymone*, ♂.  
FIG. 1085. *Z. emaciata*, paratype ♂.  
FIG. 1086. *Z. crystallophana*, ♂, West Africa.  
FIG. 1087. *Z. crystallophana* ♂, Zaire, Elisabethville.  
FIG. 1088. *Z. crystallophana*, ♂, Mozambique.  
(All  $\times 2$ )



1081



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PLATE 122

- FIG. 1089. *Zamarada janata*, paratype ♂.  
FIG. 1090. *Z. janata*, paratype ♂.  
FIG. 1091. *Z. latimargo*, ♂.  
FIG. 1092. *Z. leona*, ♂.  
FIG. 1093. *Z. tullia*, ♂.  
FIG. 1094. *Z. paxilla*, paratype ♂.  
FIG. 1095. *Z. eryma*, paratype ♂.  
FIG. 1096. *Z. eucharis*, ♂.  
(All  $\times 2$ )





1089



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1094



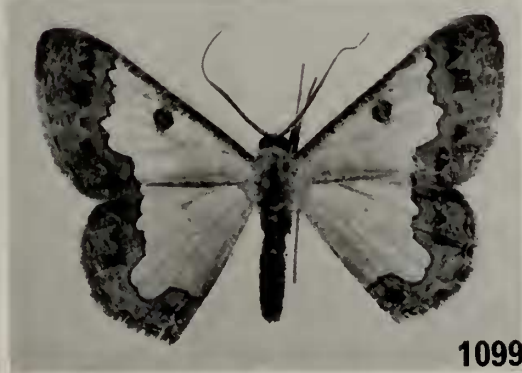
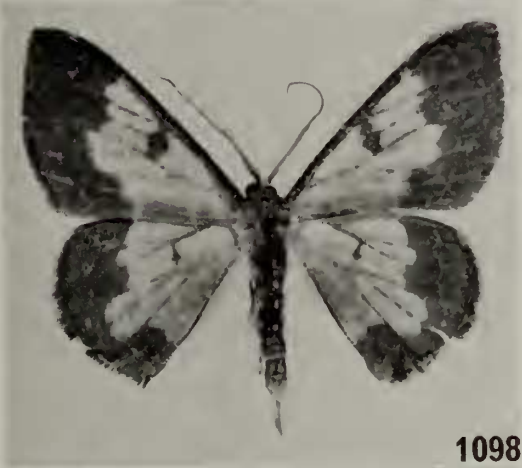
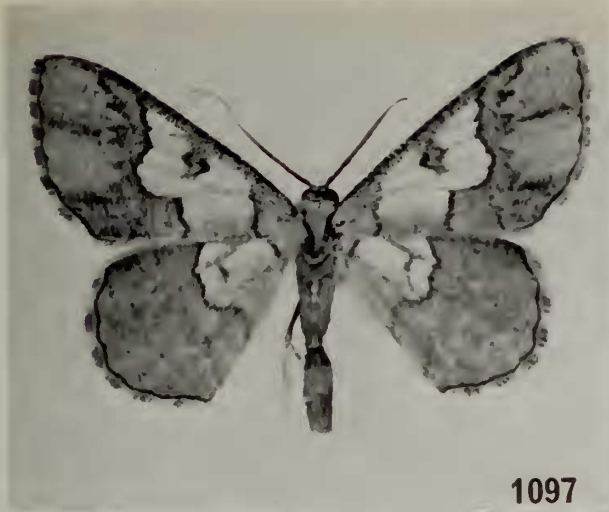
1095

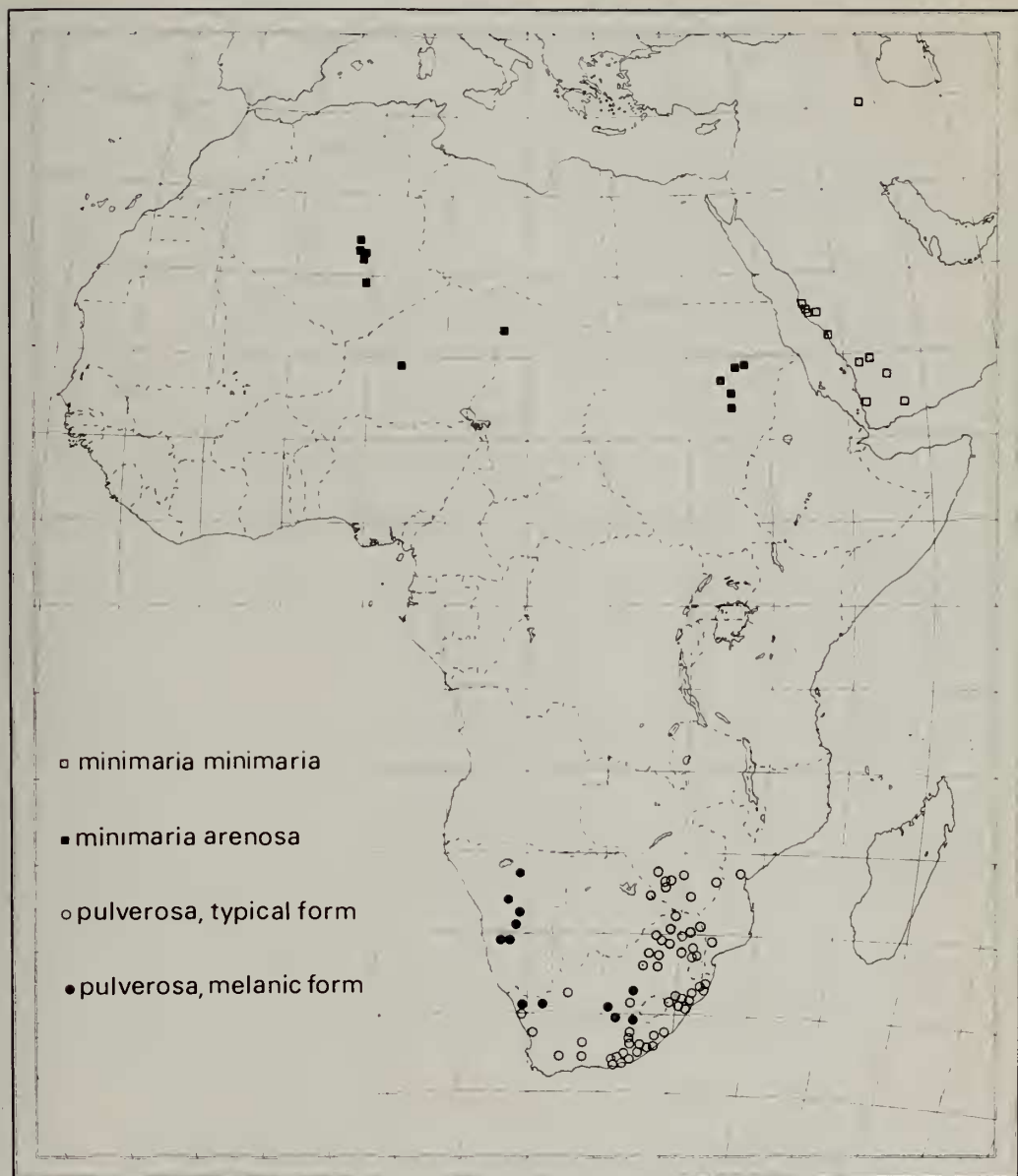


1096

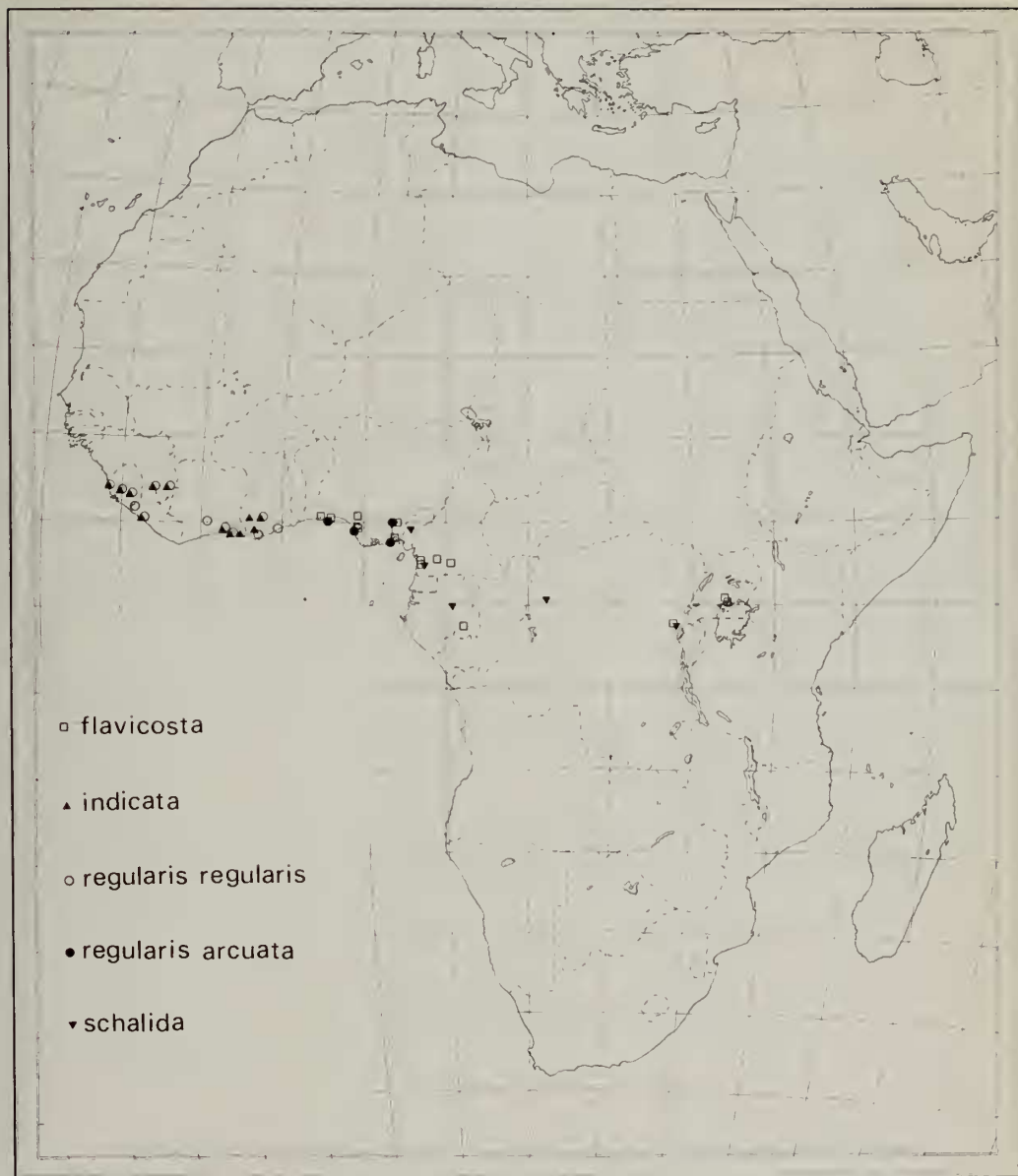
PLATE 123

- FIG. 1097. *Zamarada opala*, ♂.  
FIG. 1098. *Z. variola*, paratype ♂.  
FIG. 1099. *Z. tortura*, paratype ♂.  
FIG. 1100. *Z. weberi*, holotype ♂.  
FIG. 1101. *Z. sagitta*, paratype ♂.  
FIG. 1102. *Z. catori*, ♂.  
FIG. 1103. *Z. deformata*, paratype ♂.  
FIG. 1104. *Z. pelobasis*, paratype ♂.  
(All × 2)



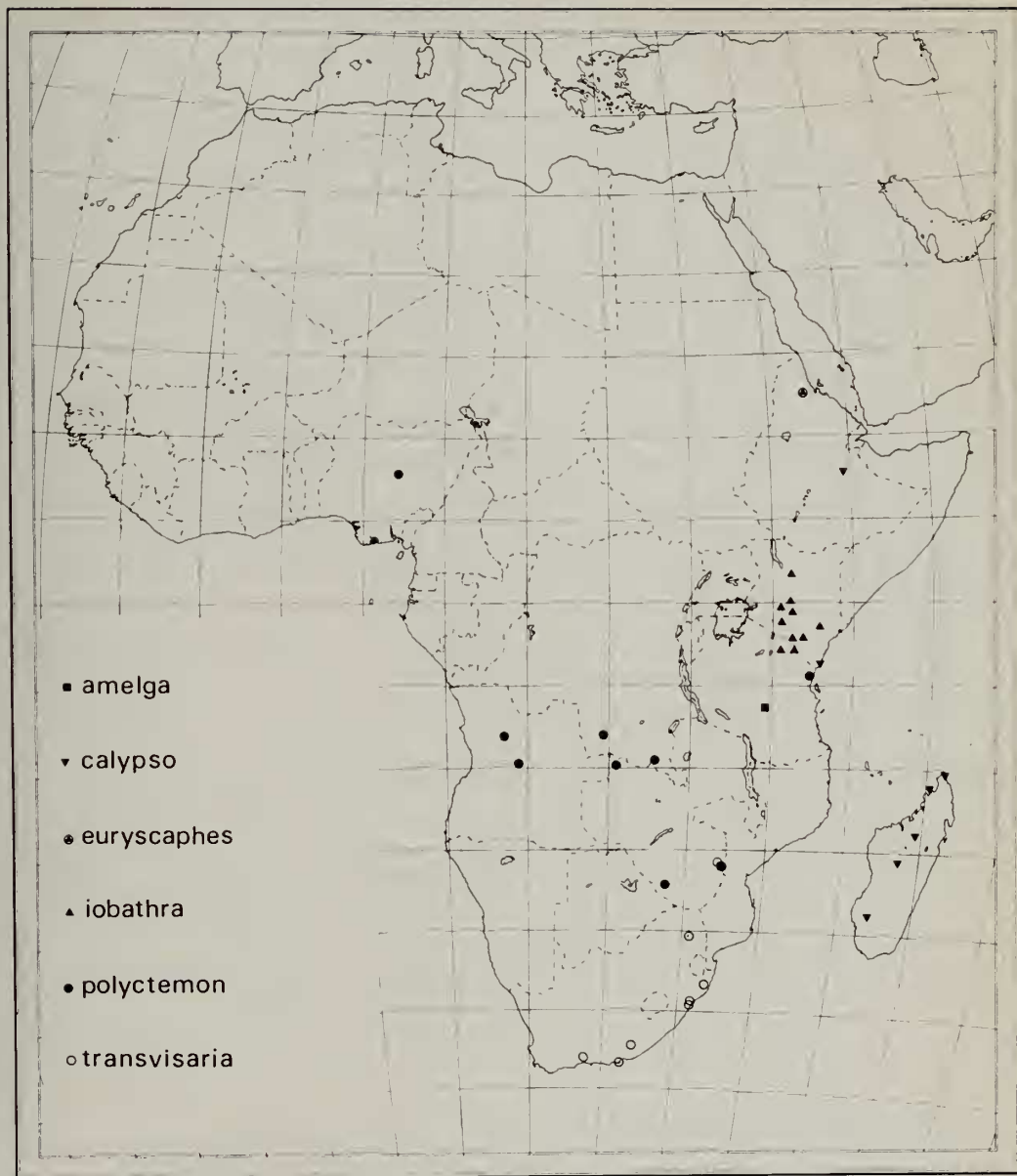


MAP I. Distribution of *Zamarada*, species *minimaria* and *pulverosa*.

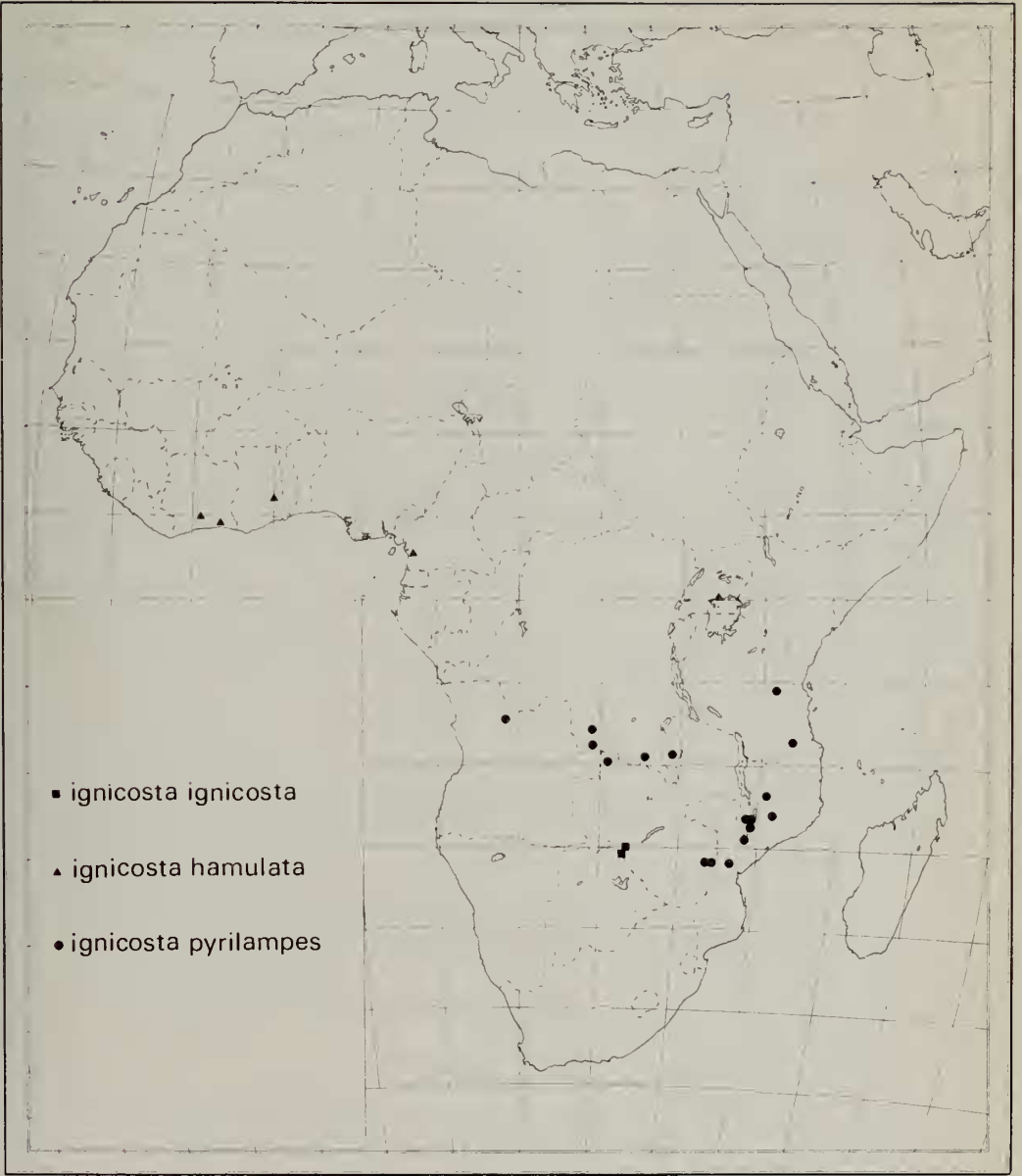


MAP 2. Distribution of *Zamarada*, species-group *flavicosta*.

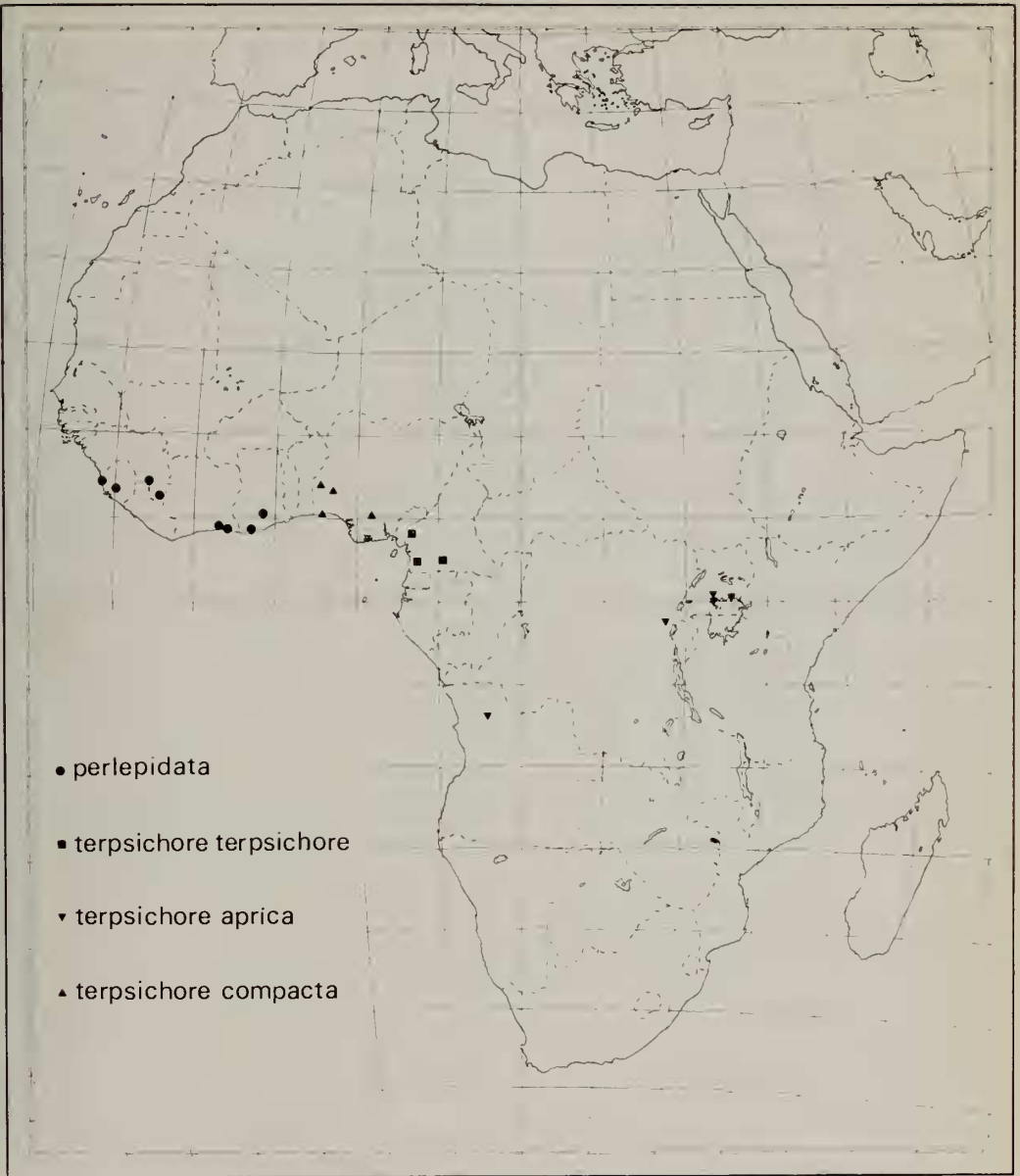




MAP 3. Distribution of *Zamarada*, species-group *polycytemon*.



MAP 4. Distribution of *Zamarada*, species-group *ignicosta*.



MAP 5. Distribution of *Zamarada*, species *perlepidata* and *terpsichore*.